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KOREA

STAFF APPRAISAL REPORT OF A

SIXTH RAILWAY PROJECT

March 10, 1978

Transportation Division
Projects Department
East Asia and Pacific Regional Office

## CURRENCY EQUIVALENTS

Currency Unit - Won

| | | |
|---|---|---|
| US$1 | = | Won 485 |
| Won 1,000 | = | US$2.06 |
| US$1 million | = | Won 485 million |
| Won 1 million | = | US$2,061 |

## WEIGHTS AND MEASURES

| | | |
|---|---|---|
| 1 m | = | 3.28 ft |
| 1 km | = | 0.62 mi |
| 1 kg | = | 2.2 lb |
| 1 l | = | 1.057 qt (US liquid) |
| 1 ton | = | 2,205 lb |

## ABBREVIATIONS

| | | |
|---|---|---|
| CPCS | - | Canadian Pacific Consulting Services |
| CTC | - | Centralized Traffic Control |
| EPB | - | Economic Planning Board |
| FFYP | - | Fourth Five-Year Plan |
| KAL | - | Korean Airlines |
| KDB | - | Korean Development Bank |
| KIST | - | Korea Institute of Science and Technology |
| KNR | - | Korean National Railroad |
| MOT | - | Ministry of Transportation |
| MRP | - | Management Rationalization Plan |
| OECF | - | Overseas Economic Cooperation Fund (Japan) |
| SMESRS | - | Seoul Metropolitan Electric Suburban Railway System |
| TCC | - | Transport Coordination Committee |
| TCO | - | Transport Coordination Office |

## GOVERNMENT OF KOREA
## FISCAL YEAR

January 1 - December 31

# KOREA
# STAFF APPRAISAL REPORT OF A SIXTH RAILWAY PROJECT

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This report is based on the findings of Bank missions which visited Korea in April-May and July 1977, comprising Messrs. Chapman (financial analyst), Ohlund (engineer), and Yenny (economist) from the Bank; and Messrs. Carrard and Kesson (consultants).

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## 1. TRANSPORT SECTOR

### General

1.01 The rapid economic growth of Korea in the past decade, coupled with industrialization, has resulted in major developments and changes in the transport sector: freight and passenger traffic tripled between 1966 and 1976. This rapid growth in transport demand was accompanied by a greater diversification among modes, as railways lost their predominant position and road transport and coastal shipping increased their share.

1.02 Traffic statistics, in Tables 1.1 /1 and 1.2, illustrate these changes over the 1966-76 decade. The rail transport share of freight traffic fell from 78% of total ton-km to 46%, while road and coastal shipping shares increased respectively from 12% to 27% and from 10% to 27%. For passenger traffic, the rail share of total passenger-km fell from 43% to 25% over the decade, while the road share increased correspondingly from 56% to 74%. These changes very much reflect the economic advantages of the various modes, as rail and coastal shipping increasingly concentrate on long distances and bulk commodities, while road transport handles short distance and more diffuse traffic.

1.03 As Korea's economy continues to grow and diversify, transport demand will continue to experience a parallel expansion. Internally, the transport system will have to cope with larger movements of bulk commodities, such as coal, cement, ores and oil. The industrial complexes being developed along Korea's south and southeast coast will necessitate the import of large amounts of raw materials and the shipment of intermediate products between plants. A more diffuse demand for nonbulk freight and passenger transport will follow the general increase in GNP.

1.04 Recognizing the necessity for the transport sector to keep up with the growing economy, the Government's basic policy in the Fourth Five Year Plan 1977-81 (FFYP) is to develop the transport system to meet increases in traffic demand. Among the other objectives stated in the FFYP documents the most important are: (a) to increase transport efficiency and ensure economic allocation among modes; (b) rate increases and improvements in operations to reduce the fiscal burden imposed on government by the railway; and (c) to favor maintenance expenditures over new investment. Other lesser objectives are described in detail in the Bank's latest Basic Economic Report dated February 23, 1977 (Reference A1). /2

1.05 The FFYP investment allocation for the transport sector is Won 2,780 billion (US$5.7 billion), or 14.6% of total investment. It is expected that 45% (Won 1,258 billion) will be invested by the public sector in infrastructure and equipment. The remaining 55% (Won 1,526 billion) will

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/1 Tables referred to in main text will be found following the annexes.

/2 Refers to material in the project file and listed in Annex 1.

be invested by the private sector, primarily for road transport vehicles and ships. The allocation for transport investment in the Fourth Plan is about 50% higher in real terms than in the Third Plan (Table 1.3). Forecast transport demand indicates that the proposed investment should provide for increases of about 34 billion passenger-km and 12 billion ton-km, respectively 30% and 180% more than during the Third Plan, thereby justifying the substantially larger capital allocation. The allocation among modes reflects the increasing importance of road transport and coastal as well as international shipping; proposed investments in these modes are, respectively, 47% and 80% above the Third Plan, while railways are allocated only 25% more than in the previous plan.

## The Transport System
(Map 13133)

### Highways

1.06 The present highway system is still inadequate to cope with the rapid growth of road transport, despite the Government's effort since 1968 to develop a modern road network. Only about half of the national highways and less than 20% of local roads are paved, and a high level of investment will continue to be required. The Bank Group has financed three highway projects, totalling US$191.5 million: Loan 769-KO in 1971 (US$54.5 million), Loan 956-KO in 1974 (US$47 million) and Loan 1203-KO in 1976 (US$90 million). Performance on these projects generally has been satisfactory.

1.07 Road transport of freight and passengers grew rapidly over the last decade and, as mentioned above, the share of road transport increased dramatically at the expense of the railways. This rapid development of road transport occurred despite the Government's restrictive licensing policy for commercial vehicles and heavy taxes which limit private automobile ownership (para. 4.02). Because of restrictive licensing, the number of common carrier trucks is about 34,000, while the private truck fleet, which is subject to less restrictive licensing, has grown to 55,000. In 1966, the number of common carrier trucks was double the number of private trucks. Private trucks can carry only the owner's goods. This limitation, together with the increasing proportion of private trucks, is lowering the efficiency of the truck fleet as a whole. The Bank therefore has been pressing the Government to relax its truck licensing system, and some relaxation was introduced in early 1977. Urban passenger traffic in Seoul moved entirely by road (mainly bus and taxis) until the subway and the railway's electrified suburban lines began operation in 1974 (para. 4.13). As congestion increases in Seoul, the share of the suburban lines will rise, although road transport will remain the dominant mode in the urban area.

### Railways

1.08 As mentioned above, major structural changes occurred in the transport sector over the last decade: the transport system is now evolving into a more balanced multi-modal system in which different traffic modes complement each other according to their technical and economic characteristics. Cost comparisons indicate that rail transport is still the most economic means of moving bulk traffic over medium and long distances, and also has an important role to play in long distance passenger traffic. In

1976, about 81% of rail freight traffic consisted of six bulk commodities, as against 69% in 1966. In addition to its long distance hauling of bulk freight and passengers, KNR will play a growing role in providing rapid transit service for Seoul and its suburbs. Details are given in Chapter 2.

1.09 Since 1962, Bank Group assistance to KNR through five projects amounted to US$220 million. The first three lending operations have been satisfactorily completed. Disbursements of the Fourth Railway Project (Loan 863-KO) are 96% completed, but the Closing Date has been extended to March 31, 1979, to allow for disbursements for equipment with long delivery times. The Fifth Railway Loan (1101-KO) made in 1975 for US$100 million is over 80% disbursed and will be completed before the end of 1978. The major requirements of the Loan/Credit Agreements covering these first five railway projects fall into four main areas: (a) KNR's status and financial autonomy; (b) KNR's financial situation; (c) railway operational and technical matters; and (d) transport coordination.

1.10 Considerable progress has been made in providing KNR with more autonomy, although it has not yet been reorganized as a public corporation or other autonomous agency, as agreed under the Second Railway Project. However, the Government has agreed to enable KNR to operate with autonomous powers by 1979. KNR earned positive returns until 1971; since then its financial situation deteriorated due to increased highway competition, which eroded profitable passenger services, sharp inflation which increased costs substantially, and tariffs, maintained at low levels by the Government, and which did not fully compensate for inflation. The requirements of covenants covering operational and technical matters have, in general, been met satisfactorily, with a consequent improvement in KNR's level of performance. Progress has been made in building up an organization in the Ministry of Transportation to coordinate transport investment, and the Economic Planning Board (EPB) is exercising a greater measure of control (para. 1.14 and 1.15). Further details on compliance with specific covenants are given in Annex 2.

Ports and Shipping

1.11 Freight traffic through the ports has increased from about 13 million tons in 1966 to over 80 million tons in 1976. This tremendous increase resulted in serious port capacity problems, particularly at Busan, the largest port, which handles 20% of the country's external trade and is chronically congested. The Bank has assisted development in Busan through two port projects and ADB is financing the expansion of Incheon, the port nearest to Seoul. The Saudi Fund for Development participated in the financing of the first Busan Port Project. The Government has also proceeded to develop a number of specialized ports in connection with industrial development. The latter is largely concentrated on the coast: i.e. Bugpyeong for cement, Pohang for the inputs and output of the steelmill, Onsan for a refinery and nonferrous metal industry, and Samil for fertilizer and petrochemicals.

1.12 The role of coastal shipping has greatly increased in the last decade, from 10% of the ton-km moved in Korea in 1966 to 27% in 1976. This is mainly due to the construction of industrial complexes on coastal locations, and, to a lesser extent, to shortages in rail and road capacity. Korea's

share in the merchant shipping of its external trade has been increasing and reached about 38% of total tonnage in 1976.

Aviation

1.13 Although domestic air passenger traffic grew rapidly until 1973, it still amounts to less than 1% of total passenger-km; air-freight is also negligible. Domestic routes are served by the privately-owned Korean Airlines (KAL), which also operates internationally. Most international traffic is handled at the Seoul-Kimpo International Airport; other international airports are at Busan and at Jeju Island, a major tourist center.

## Transport Policy Planning and Coordination

1.14 Over the past two years, the Government has taken steps to improve transport coordination. In 1975, this function was reorganized by the establishment of a Transport Coordination Committee (TCC) consisting of nine directors, representing ministries most directly concerned with transport matters, and a Transport Coordination Office (TCO) in the Ministry of Transportation (MOT Chart 18023). The TCO is headed by a director general, who also acts as Chairman of the TCC. Its main functions are to collect data and assist in the formulation and review of transport policies, especially those related to pricing and regulation.

1.15 While the charter of the TCC includes intermodal coordination of transport sector investments, the TCC has not in fact exercised this function. The Economic Planning Board (EPB), which exercises budgetary control and plays a senior role with regard to all other ministries, has the dominant role in decision on investment projects. EPB intends to make much more intensive reviews of investment projects and has established a separate Bureau of Project Evaluation to this end. Sector studies covering major aspects of transport coordination have been identified by the sector mission and are included in the Project (para. 3.07). They will be carried out under the supervision of EPB.

1.16 This approach appears much more satisfactory and workable than the one where investment coordination was to come under one of the ministries, namely MOT. The role of the TCO should remain one of collecting basic data in the sector and assisting in the formulation and review of transport policies, especially those related to pricing and regulation, since MOT is responsible for licensing and rates and fares setting.

1.17 The Bank should continue to assist the Government in increasing the capacity of its transport system to cope with the demand resulting from the continuous rapid development of the country. Since transport infrastructure is capital-intensive, the Bank can ensure through careful project preparation that capacity increases are provided at the least cost to the economy, and that efficient use is made of existing capacity prior to increasing it.

## 2. RAILWAY SUBSECTOR

### KNR Organization

2.01 KNR is a semi-autonomous agency within the Ministry of Transportation, with its own management, accounts, and section of the national budget. The legal basis for KNR's administration and operation is set out in: (a) Law for Government Organizations No. 2907, revised December 31, 1976; and (b) KNR Organization - Presidential Decree No. 7310, dated November 4, 1974. The Government, largely through the EPB, exercises control over staff, financial, budgetary and tariff matters. The Director General of KNR is appointed (often from outside the railway) by the Government /1, while the Deputy Director General comes from within KNR and is in charge of the day-to-day operations. Chart 18024 shows KNR's organization.

### Management, Staff, Training

2.02 Management is generally satisfactory, but there remains a need to strengthen certain aspects, especially the capability for development of technical, financial and economic policies and investment planning. The Government has recognized the situation and proposed that a management study be carried out by consultants (to be mostly Korean with support from some overseas specialists). The Bank has agreed to finance this study (which will take about six months) from Loan 1101-KO, in accordance with terms of reference prepared by the Bank (Reference B-1) and presently being reviewed by the Government and KNR. Agreement on the terms of reference was reached during loan negotiations.

2.03 Pending the results of the above management study, KNR has prepared and is now carrying out a Management Rationalization Plan (MRP). The main items of this plan are:

(a) Cost savings due mainly to manpower reductions arising from such measures as mechanization, improved operations, closing or rationalizing of lines and stations, and reorganization of administrative functions; and

(b) Revenue increases due to improving and upgrading passenger services and baggage handling, expansion of container services, provision of private sidings, reclassification of freight rates (para. 2.30), and improvements to the passenger fare structure.

The expected cost savings and additional revenues are incorporated in the financial projections discussed in Chapter 5.

2.04 The number of permanent employees with Government civil service status was about 33,500 at the end of 1976, a figure which has remained almost constant for about five years. The financial forecasts assume that there will be no major increase over the project period (to end of 1979). In addition, KNR employs about 6,000 semipermanent and temporary personnel,

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/1 The present Director General was appointed from the railway staff.

some on a seasonal basis, in workshops and on track works. Staff productivity in terms of traffic units (pass-km plus net ton-km) per employee is high (1976 - 600,000) compared with other railways; this is due in part to the dense urban and inter-city passenger travel and heavy bulk mineral and commodity traffic. In general, the staff continues to display excellent discipline and productivity.

2.05 Basic salaries per employee (excluding management), which were raised by about 20% on January 1, 1978, range from about W 33,000 to about W 198,000 per month and are in line with Government pay scales. Allowances, which increase with length of service and range from W 20,000 to W 120,000 per month, were also raised on January 1, 1978, by about 10-40%. Staff remuneration is lower than in comparable private industrial and commercial enterprises in Korea, and this causes some difficulties in retaining qualified and experienced personnel.

2.06 KNR's training programs were reviewed by the Bank during the Fifth Railway Project and were found to be fundamentally sound and generating considerable interest among the staff. The main problem lies with a lack of equipment and material for practical training; agreement has been reached on required items and their purchase is being financed from the Fifth Railway Project.

## Railway Facilities

### Tracks

2.07 The system consists of 3,097 route-km of standard guage (1.435 m) and 47 km of narrow gauge (0.76 m) lines; 567 km are double track and the remainder single track (Table 2.1 and Map 13134). There are many lines in mountainous areas, with some sections having gradients up to 2.5% and 3%, along with numerous sharp curves. There are about 140 km of tunnels and 97 km of bridges. The main lines are laid with 50 kg/m rail, while secondary branch lines have mostly 50 kg/m and 37 kg/m rail (see Table 2.2); all new rail renewals are carried out with 50 kg/m rail. Sleepers are predominantly timber, but locally manufactured pre-stressed concrete sleepers are being used as replacements on the higher speed lines. Rail joint welding is also being carried out on a limited basis on such lines, with about 190 km completed to end 1976 and another 90 km planned for 1977-81. The mission recommended that KNR consider a larger program of rail joint welding because of the economies in maintenance that can be obtained. All lines have crushed stone ballast.

2.08 During the proposed project period (1978-79), KNR plans to carry out renewal of about 330 track km of worn out rails, of which about 70 km are in connection with complete track renewal. KNR will also increase the use of concrete sleepers and continue its ballast renewal program. Equipment for partial mechanization of track renewal and maintenance work has been provided under the Fifth Project. Under the new project, KNR intends to set up a workshop for the manufacture of points and crossing components, the preparation of timber sleepers and the rehabilitation of used track material.

2.09 Existing double track lines are the Gyeong Bu and Gyeong In lines and the section Bongyang-Jecheon of the Jung Ang line. The double tracking of the Ho Nam line between Iri and Daejon (89 km) is being completed, and work has started on quadrupling part of the Yeongdeungpo-Suweon section in the densely trafficked Seoul urban area. Works to increase the capacity of the Chung Bug line (to give an additional access between the industrial northeast and the Seoul-Busan main line), by upgrading and partial doubling, are included in the present project.

2.10 In step with the increasing traffic and train size requirements, additional and lengthened crossing loops and enlarged marshalling yards have been - and more are to be - provided.

2.11 The single track industrial lines between the northeast and Seoul are electrified; an extension of electrification on the Jung Ang line from Jecheon to Yeongju has been proposed for consideration in the 1980/81 period (para. 3.03). Most of the Seoul urban tracks are also electrified, in association with the Seoul Metropolitan Electrified Suburban Railway System (SMESRS); extension of electrification to the Seoul-Susaeg urban line is proposed under the new project.

Signalling

2.12 Centralized traffic control (CTC) has been installed in the Seoul urban area and on the heavily trafficked electrified single line Seoul-Jecheon. Under the new project, CTC is to be installed on the Dae Gu line (about 35 km) and between Yeongju and Gyeongju on the Jung Ang line (about 164 km). Automatic block operation is provided on the Seoul-Busan double line. Most of the other main lines are equipped with tokenless block signalling and interlocking systems. For safety, an automatic train stopping system is being installed under successive projects.

Motive Power and Rolling Stock

2.13 KNR's motive power and rolling stock fleet at the end of 1976 are given in Tables 2.3 and 2.4. The fleet consists of 386 diesel and 69 electric locomotives (with about 20 steam locomotives still in service on shunting duties), 120 diesel rail cars, 128 electric rail cars (on the Seoul urban electrified lines), about 1,800 passenger cars, and about 16,000 freight cars (with another 1,400, mostly tank cars, privately owned). Another 20 electric locomotives, 90 electric rail cars and 750 freight cars, not included in the project, are ordered or being ordered for delivery during 1977 and 1978. An additional 30 diesel locomotives, 211 passenger cars and 1,420 freight cars are included in the project. Fifty-two of the diesel locomotives have recently been re-powered; another 59 are to be re-powered under the proposed project.

2.14 Under the Fifth Railway Project KNR agreed:

(a) to submit a firm plan acceptable to the Bank to ensure:

(i) the satisfactory maintenance of KNR's fleet of locomotives and rolling stock; and

(ii) rehabilitation of out-of-service diesel locomotives; and

(b) to appoint for a period of not less than two years a technical adviser to assist KNR in the implementation of the aforesaid plan.

After some delay, a technical adviser from Canadian Pacific Consulting Services (CPCS) has been provided for a two-year period from September 1976, and the implementation of the maintenance and rehabilitation plans are now under way. The adviser's first reports (Reference B2), however, indicate that much needs to be done to clean up the workshops and to organize rational programs for inspection and maintenance; all of which will require considerable effort by KNR over the next few years. The transfer of all passenger and freight car maintenance operations to the new workshop at Daejeon (para. 2.15) should facilitate the new improved maintenance methods being adopted. Improved training facilities now being provided (para. 2.06) should also help in the longer term. Sufficient spare parts to carry on the improved maintenance program have been or are being procured under the Fifth Railway Project. Further measures to be taken will be included in the action plan to be prepared by KNR (para. 3.20).

Workshops

2.15 KNR has at present four main workshops: at Seoul (electric locomotives, passenger cars, freight cars, diesel rail cars and electric rail cars), Yeongdeungpo (steam locomotives, passenger cars and freight cars), Busan (diesel locomotives, passenger cars and freight cars), and Incheon (passenger cars and freight cars). Steam locomotives are expected to be completely phased out by 1979. A new freight car workshop is being constructed at Daejeon and will be completed in 1978; a new adjacent passenger car shop is proposed under the project (paras. 3.14 and 4.14). KNR is planning to transfer all passenger and freight car maintenance to the new workshops at Daejeon and, by about 1980, to close the existing workshops at Yeongdeungpo and Incheon after transferring usable equipment to other workshops. Provision is also made in the project for necessary improvements to remaining running sheds for locomotives, rail cars and passenger and freight cars.

Telecommunications

2.16 A microwave system has recently been installed between Seoul and Busan, and a start has been made on providing improved station-to-station and station-to-train communications. The latter is to be continued under the project.

Other Property

2.17. In general, the buildings, stations, offices and general plant of the railways are reasonably maintained. A considerable program of bridge strengthening, carried out under the Fourth and Fifth Railway Projects, is to be continued under this project.

## Traffic

### Freight Traffic

2.18 KNR's freight traffic statistics from 1966 to 1976 are given in Tables 2.5 through 2.7. During this period, freight traffic grew 6.2% p.a. in tons and 6% p.a. in ton-km. Major commodities which contributed to these increases were cement and coal. Cement transportation increased from 1.7 million tons in 1966 to 10.2 million tons in 1976, and coal rose from 10.5 to 16.1 million tons during the same period. In 1976, freight traffic was 43.8 million tons and 9.7 billion ton-km, the average transport distance was 222 km. Freight net ton per route km averaged 3.1 million in 1976. Preliminary results for 1977 indicate that ton-km are in line with the forecast given in Table 2.7 and 8% above 1976. Freight densities (see Char. 18070) are higher on KNR industrial lines between Seoul and the northeast region of coal mines and cement plants, exceeding 13 million tons on the heaviest section. The next highest freight densities are on the Jung Ang line south of Jecheon and on the Seoul-Busan line, with the busiest sections carrying around 4 million tons annually.

2.19 Bulk commodities best suited for rail transport - such as coal, cement, ore, oil, fertilizer, and grain-accounted for 81% of KNR's total freight ton-km in 1976, up from 69% in 1966. Apart from some military and KNR's own transport, the remainder consists mainly of general cargo. Tonnage of this carried by KNR since 1966 has fluctuated between 4.5 and 6 million tons per annum, reacting to factors such as the opening of the Seoul-Busan expressway in 1970 (much of the general cargo originally carried by KNR was suitable for highway transport),and the economic slowdown in 1975.

2.20 Freight traffic forecasts from 1977 to 1981 are given in Tables 2.5 through 2.7. They take into account the expected increases in production of bulk commodities during the FFYP, and prospective competition from other modes, namely coastal shipping and road transport (Reference C1). The forecast for coal transport is based on the targeted national production of 24 million tons in 1981. While the government will do its utmost to reach it, this target is ambitious and a delay of about one year is not unlikely. Nevertheless, the target has been accepted for coal car acquisition in 1978-79 to avoid creating a bottleneck should the production indeed be on target. The acquisition program for the last two years of the FFYP could then be adjusted if necessary. General cargo has also been assumed to grow over the plan period, as the heavy metal and machinery industry develops and generates inputs and outputs suitable for rail transport. The development of container services between Seoul and Busan will also contribute to the growth of general cargo suitable for rail transport. In 1977 general cargo tonnage was 43% above the same period of 1976.

2.21 Overall, the average freight traffic growth rate has been estimated at 7% p.a. in tons and 7.5% p.a. in ton-km; it is projected to reach 62 million tons and 14 billion ton-km by 1981, with the basic composition of traffic remaining unchanged. These forecasts were discussed and agreed with KNR, and appear realistic (with the above reservation on coal). However, in

view of past experience where freight forecasts generally have been proven over optimistic, traffic development should be closely monitored and reviewed by KNR and the Bank before finalizing investments in the last two years of the FFYP (para. 3.03).

Passenger Traffic

2.22 Tables 2.8 through 2.10 show KNR's passenger traffic statistics from 1966 to 1976, as well as forecasts to 1981. Significant changes occurred during this period which greatly affected passenger traffic. They were the opening of expressways in 1970-71, followed by the development of long distance bus transport; the rise in personal incomes, which increased mobility and the demand for greater comfort, resulting in a shift to the higher class trains; and, finally, the opening in 1974 of the first Seoul subway line connected to KNR's electrified suburban lines.

2.23 Regarding long distance travel, passenger traffic grew regularly until 1969, when it reached 115 million passengers and 9.7 billion pass-km. Due to sharp bus competition, particularly following the opening of the Seoul-Busan and the Daejon-Gwangju expressways, the number of long distance passengers fell to 85 million in 1971. By 1973, however, passengers and pass-km were back to their 1969 levels, and both have been growing steadily since then, despite the 1974-75 economic slowdown. In 1976, the number of long distance passengers was about 7% above 1975 and, according to preliminary results, the growth in 1977 was 11%.

2.24 As mentioned above, the growth in long distance passenger traffic has been paralleled by a shift from lower class (ordinary) trains to limited express and special express. The number of passengers on express trains quadrupled in the last five years, while the number of ordinary passengers remained almost constant (Table 2.9).

2.25 Regarding the Seoul urban system, SMESRS (Seoul subway plus the KNR electrified suburban lines), passenger traffic grew rapidly from the start of service in 1974 ad reached 134 million passengers in 1976; of these, 100 million were KNR passengers and 34 million Seoul city subway passengers. In 1977 urban passenger traffic was 40% above 1976.

2.26 In view of these recent and major changes in passenger traffic patterns - both for long distance and urban services - and the resulting absence of well-established trends, it is difficult to forecast future traffic. To illustrate this point: in 1977, special express passengers were up 23% and limited express passengers up 84% from the same period in 1976. The best possible forecast agreed with KNR is for a 3.7% p.a. overall growth in long distance passengers and a 6% p.a. growth in pass-km. This would result in 156 million passengers and 15.6 billion pass-km by 1981, with most of the growth occurring in the special and limited express categories. For Seoul (SMESRS), a doubling of the number of passengers, to 209 million by 1981, has been assumed until the results of a comprehensive urban transport study are available (para. 4.13). Even more than for freight traffic, further developments in passenger traffic should be closely monitored to ensure that investments are compatible with demand - not only in terms of quantities, but also in terms of the quality of service demanded by KNR's customers.

## Operations

2.27 Table 2.11 gives a summary of KNR's operating statistics for 1971-76. Operating efficiency and utilization of available equipment remain high and, in some aspects, continue to improve: for example, annual pass-km per available passenger car (from 5.7 to 8.1 million) and freight net ton-km per available freight car (from 600 to 680 thousand). On the other hand, availability of equipment remains lower than expected and, in the case of cars, is not likely to reach the targets set for the end of 1977 in the Plan of Action for improved availability under the Fifth Project (Annex 5, Appraisal Report No. 610a-KO). In 1976, availability of passenger cars was 88.7%, compared with the target for this year of 90%; for freight cars, availability was 89.3% against the target of 93%. There were delays, however, in the appointment of the technical advisor on equipment maintenance (para. 2.14), in the supply of spares and components, and in the provision of new centralised freight and passenger workshops (para. 2.15). With varying progress now being made on all three aspects, it should be feasible to improve the situation during the 1977-81 investment plan period. Operational forecasts are defined in para. 3.19.

## Tariffs and Costs

2.28 Tariffs are uniform throughout the system, and are regulated by the Government; the latter, in exercising controls on the prices of essential commodities, has held railway freight rates at low levels. For many years, freight revenues have not covered the fully distributed costs of moving the traffic, although passenger traffic had been profitable until 1976. The following table gives average cost and revenue comparisons for the years 1973-76:

| | Freight | | Passenger | |
|---|---|---|---|---|
| | Cost per ton-km | Revenue per ton km (Won) | Cost per pass-km | Revenue pass-km |
| 1973 | 2.27 | 1.84 | 1.76 | 2.14 |
| 1974 | 3.14 | 2.31 | 2.44 | 2.97 |
| 1975 | 4.05 | 3.34 | 2.93 | 3.53 |
| 1976 | 5.76 | 4.64 | 3.69 | 3.67 |

2.29 Action on tariff increases over the last ten years is detailed in Tables 2.12 through 2.14. These show that, since 1973, the Government has permitted KNR to increase freight tariffs at a rate faster than passenger fares, thereby reducing KNR's dependence on passenger traffic revenues. However, coal, which constitutes 38% of total railway freight traffic, is carried at the lowest class rate (class 4); grains, fertilizers, limestone and ores (18% of total freight traffic) are rated at class 3.

2.30 The last tariff increase was in January 1977, when the five existing freight class rates were restructured to four classes by combining classes 1 and 2 (at existing class 1 rate) and moving up the remaining classes, with some additional increases in the rates for the new classes 2, 3 and 4. This raised average revenues per ton-km by about 19%. The spread between the lowest and highest class rates, which used to be as much as 110%, has now been reduced to 32%. This is good, and in fact, the spread could be further reduced by merging class 4 with class 3. Passenger fares have not been increased since July 1975.

2.31 KNR's operating costs are low, due to a high degree of utilization of rail facilities and rolling stock, low salaries and wages, and high staff productivity. Cost analysis indicates that in 1976 the average fully distributed costs were about W 3.69 (US¢0.76) per pass-km and W 5.75 (US¢1.19) per freight ton-km; these costs are somewhat understated, since KNR's expenditure on maintenance was below the minimum level. However, these average costs should rise in 1977, with a better supply of maintenance spares becoming available.

2.32 The cost data given for 1976 in Table 2.15 indicates that high class, express passenger services earn a good profit margin, but that lower class, ordinary passengers and commuters and baggage service lose money. All freight classes except cement lose money, particularly grain, fertilizer, ores and coal. However, all passenger services (except commuters) and all major freight traffic revenues (except for grain and military) covered variable costs and made full or partial contributions to overheads.

2.33 For KNR to reach a satisfactory financial position, the level of tariffs must be raised. Prompt action should be taken in the future to maintain a satisfactory level in the face of inflation. Future increases should be selective rather than across the board. For instance, ordinary and commuter passenger fares should be raised to a greater extent than the higher class fares. KNR is already proposing a considerable increase in baggage charges. Regarding freight traffic rates, where the need is greater, more emphasis is needed on raising the charges on grains, fertilizers, ores and coal (para. 5.08). Agreement was reached during loan negotiation on increases in both passenger fares and freight rates (para. 5.22).

## Budget, Accounting, and Audit

### Budgets

2.34 KNR prepares detailed annual operating and investment budgets. Through the Government Office of Audit, expenditures are rigidly controlled against the very detailed budget provisions. KNR management has very little flexibility in reallocating budget funds and, when other than minor revisions are needed, approval must be sought from the House of Representatives. Agreement was reached at loan negotiations on measures to allow KNR to submit its budgets in a commercial form, to give KNR more flexibility in reallocating budget funds and to allow KNR fix the emoluments of its staff.

Accounting

2.35 A requirement of the Fifth Project was that KNR would, within 12 months, complete the installation of a commercial accounting system devised by consultants /1, and would install a traffic costing system. Implementation of the computerized, commercial accounting system has been subject to considerable delay, largely due to KNR's inability to provide sufficient qualified and experienced accounting staff - particularly staff with computer experience - to work with the consultants. Actual implementation commenced during 1977, and should be completed in 1978.

2.36 KNR has been using a manual traffic costing system introduced by the consultants in 1970. A new, computerized system has been devised by the present team, and will be introduced when the accounting system is working satisfactorily.

Audit

2.37 In accordance with loan requirements that KNR retain auditors satisfactory to the Bank, international firms (latterly with local affiliation), have been auditing KNR's commercial accounts since 1967. To date: (a) the auditors have not been able to give a clear audit certificate, due to deficiencies in operating the accounting system; and (b) KNR has not been able to comply with the requirement that the Bank receive a copy of the audit report not later than five months after the end of fiscal year, largely due to delays in appointing the auditors. However, accounting has been improving with the aid of consultants, and the audit report for 1976 was received within six months. At negotiations it was reaffirmed that audited accounts for 1977 and thereafter will be submitted to the Bank within five months of the end of the fiscal year.

Uneconomic Lines and Stations

2.38 Data from KNR's 1975 costing study has indicated seven branch lines, totalling 164 km, on which the operating ratio was over 400% (Table 2.16). A decision to close the An Seong line will be made in 1978, while the Korea Electric Co. has agreed to bear the costs of the Yong San line as from 1977. KNR is negotiating with the Korea Coal Corporation to bear the costs of the Hwa Sun line. The Jin Sam, Og Gu and Kim Po lines are all used exclusively by military authorities, who do not wish the lines to be closed. KNR is discussing with the Ministry of National Defense the possibility of the latter bearing the costs of operating these lines. Regarding the Su In line, the Government is studying the future traffic demand arising from the construction of an industrial estate near Suweon, and will make a decision on the future of this line, and on other uneconomic lines, by mid-1979.

2.39 KNR has identified 145 stations where revenues from passenger services fail to cover 30% of the personnel costs involved, 97 stations were freight revenues fail to cover 30% of personnel costs, and 230 stations where baggage revenues fail to cover 100% of labor costs involved. Action

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/1 Touche, Ross and Co., Canada.

is proposed over the years 1977-79 to close 36 of these stations, change 56 into crossing stations only (i.e. used to arrange train meets, but without either passenger or freight services), and to simplify operations at 70 stations for passengers and 49 stations for freight services. This would eliminate about 166 employees and save about W 320 million in 1979. The proposed measures appear to be satisfactory. Action as above was actually taken on 132 stations in 1977.

## 3. INVESTMENT PLAN AND PROJECT

### KNR's Investment Plan (1977-81)

3.01 As a result of discussions during appraisal, KNR's Investment Plan, which forms part of the Fourth Five-Year Economic Development Plan of Korea, 1977-81, was substantially revised, both in regard to its size and to the phasing of expenditures. The revised plan, as agreed between the Government and the Bank, comprises investments totalling W 503 billion (US$1037 million), with a foreign exchange component of W 211 billion (US$436 million). This includes items carried over from the 1972-76 Investment Plan, such as the new Daejeon freight car shop, completion of double tracking of the Honam line and the purchase of electric locomotives. It also includes items which are being financed under Loan 1101-KO: for example, rails and freight cars.

3.02 The composition and cost of the plan are shown in detail in Table 3.1, a summary of which is given below.

KNR 1977-81 INVESTMENT PLAN

| | W billion | | | US$ million | | | % of total expenditure |
|---|---|---|---|---|---|---|---|
| | Local | Foreign | Total | Local | Foreign | Total | |
| New line construction | 10.97 | - | 10.97 | 22.62 | - | 22.62 | 2.2 |
| Electrification | 4.69 | 3.96 | 8.65 | 9.67 | 8.16 | 17.83 | 1.7 |
| Increase in station and line capacity | 86.24 | 9.65 | 95.89 | 177.80 | 19.90 | 197.70 | 19.0 |
| Way and structures | 41.96 | 18.22 | 60.18 | 86.52 | 37.57 | 124.09 | 12.0 |
| Motive power and rolling stock | 46.21 | 133.06 | 179.27 | 95.28 | 274.36 | 369.64 | 35.7 |
| Motive power and rolling stock repair facilities | 15.68 | 8.87 | 24.55 | 32.34 | 18.28 | 50.62 | 4.9 |
| Miscellaneous | 17.70 | 1.58 | 19.28 | 36.51 | 3.25 | 39.76 | 3.8 |
| Subtotal | 223.45 | 175.34 | 398.79 | 460.74 | 361.52 | 822.26 | 79.3 |
| Contingencies | 68.15 | 35.99 | 104.14 | 140.52 | 74.21 | 214.73 | 20.7 |
| Total | 291.60 | 211.33 | 502.93 | 601.26 | 435.73 | 1036.99 | 100.0 |

3.03 Items started before or during 1977 total about W 119 billion, of which about W 77 billion is expected to be spent in 1977 (Table 3.2). They include: (a) ongoing works, such as the completion of double tracking of the sections Yeongdeungpo-Anyang on the Gyeong Bu line and Daejeon-Iri on the Ho Nam line, by-pass lines, station extensions and improvements, rail and track renewal, and the new Daejeon freight car shop; and (b) material and equipment already ordered or being ordered, such as new electric locomotives and rail cars, new passenger and freight cars, and rails. Investments starting in the 1980/81 period of the plan, totalling about W 187 billion (Table 3.3), will be subject to further adjustments on the basis of actual traffic developments in the next two years. Also, detailed technical, financial and economic analyses should be performed during the intervening two years for some of the major fixed capacity investments proposed for 1980/81: that is, double tracking, electrification and signalling. Assurances were obtained during negotiation that KNR will submit these studies and justification, for agreed items and in agreed format, to the Bank by the mid-1979.

3.04 The plan as now drawn up assumes continued high operational efficiency and improving availability of motive power and rolling stock.

## The Project and the Proposed Loan

3.05 The project to be financed under the proposed loan consists of the plan investments, intended to start in 1978 and 1979 (Table 3.4). Total cost of the project is estimated at W 197 billion (US$406 million equivalent), with a foreign exchange component of about US$190 million, of which US$120 million would be covered by the proposed loan. A summary of the estimated project expenditure and items to be financed by the proposed loan is given in the following table.

| | Total project cost | | | Proposed loan |
|---|---|---|---|---|
| | Local | Foreign | Total | |
| | (US$ million) | | | |
| New line construction (industrial sidings) | 4.74 | - | 4.74 | - |
| Electrification | 1.65 | 1.73 | 3.38 | - |
| Increase in station and line capacity (including double tracking, bypass lines, additional crossing loops, yard extensions, freight handling facilities, lengthening of crossing loops, station installations and signalling) | 60.81 | 7.26 | 68.07 | - |
| Way and structures (including rail and track renewal concrete sleepers, points and crossings, bridge and tunnel strengthening, ballast, road crossings, track material, workshop and right-of-way improvements) | 43.13 | 14.76 | 57.89 | 14.76 |
| Motive power and rolling stock (including new diesel locomotives, breakdown cranes, passenger cars and freight cars and remodelling of locomotives, railcars, breakdown cranes, passenger cars and freight cars | 24.11 | 126.34 | 150.45 | 84.65 |
| Rolling stock repair facilities | 18.68 | 11.14 | 29.82 | 3.31 |
| Miscellaneous (including telecommunications, power facilities, housing, training and technical assistance) | 13.73 | 0.72 | 14.45 | 0.62 |
| Contingencies | 49.88 | 27.73 | 77.61 | 16.16 |
| Subtotal | 216.73 | 189.68 | 406.41 | 119.50 |
| Transport sector studies (para. 3.07) | | | | 0.50 |
| Total | 216.73 | 189.68 | 406.41 | 120.00 |

3.06 The proposed loan would cover acquisition of rails, passenger and freight cars, breakdown cranes, workshop machinery, and provision of training equipment and technical assistance (Table 3.5). The remaining foreign currency items, including electrification, increase of line capacity, diesel locomotives, re-engining of diesel locomotives and diesel railcars and workshop equipment, would be financed by other agencies (para. 3.17).

3.07 Transport Sector Studies. The Government is strengthening its transport sector analysis capability, but has requested Bank assistance to do so. As a first step, EPB intends to have studies done in the following areas: (a) distribution of major bulk commodities, such as coal, cement and oil; (b) costs and tariffs of various modes, to ensure economic allocation of traffic; and (c) passenger transport demand by various modes. The Government intends to have these studies carried out by local consulting firms with the assistance of foreign experts in specialized fields, such as the bulk handling of major commodities in the case of (a) above. This was confirmed during negotiations. The proposed loan would include US$500,000 to finance about 70 man-months of such foreign experts assistance. Local costs of the various studies would be determined when the terms of reference are prepared and agreed with the Bank. This procedure and timing of the various studies was agreed during negotiations, together with terms of reference for the study in (a) above. The findings of the studies would be valuable in a variety of feasibility studies of transport investment projects, and will provide useful experience for local consulting firms in the transport field. In particular, it is expected that the bulk commodity study would lead to a project for Bank financing.

## Description of Main Project Items

3.08 The main project items are described in the following paragraphs.

### New Line Construction

3.09 New line construction comprises only two new industrial sidings.

### Electrification

3.10 Electrification is limited to the Seoul-Susaeg suburban line in the Seoul City area, subject to justification under the Seoul Urban Transport Study to be carried out by Korean consultants (para. 4.13).

### Increase in Station and Line Capacity

3.11 The main items under this category are:

(a) Double tracking of the section Gongjeon-Bongyang (8.6 km) of the Chung Bug line, to increase its capacity as an alternative route between Seoul and coal mines and cement plants of the northeast region;

(b) Double tracking and electrification of the Yongsan-Susaeg and Seongbug-Euijeongbu suburban lines (Seoul), to carry increasing suburban traffic. As for the electrification of Seoul-Susaeg (para. 3.10), the Seoul Urban Transport Study will review and check the justification;

(c) Additional crossing loops at seventeen places on eight lines throughout the system, to increase train capacities;

(d) Marshalling yard extensions at Jecheon (from 1000 to 1440 cars per day) and at Deogha, south of Ulsan, (from 30 to 350 cars per day), to deal with industrial expansion;

(e) Extensions to station yards at seven stations on three lines of the system;

(f) Expansion of Susaeg, as the principal West Seoul Terminal for improved coal and cement handling, and Bugog, similarly to serve South Seoul;

(g) Lengthening crossing loops at three stations on the single track section of the Ho Nam line, to take longer trains and give increased capacity;

(h) Additional passenger platforms at Seoul central station, new station buildings at 30 stations, underground passages at eight stations, new passenger sheds at twelve stations and new freight sheds at 30 stations; also included are about 100 sets of automatic ticketing machines; and

(i) Installation of centralized traffic control system (CTC) on the Dae Gu Line between Dongdaegu and Yeongcheon (35 km), and on the Jung Ang Line between Yeongju and Gyeongju (about 163 km); extensions of automatic train stopping systems, interlocking signals, and level crossing warning devices.

Way and Structures

3.12 The main components are:

(a) Rail renewal on about 260 km of track (see Table 3.6, Reference C-2);

(b) Complete track renewal over about 70 km (see Table 3.7, Reference C-2);

(c) Provision of concrete sleepers (about 150,000);

(d) Provision of ballast (about 320,000 cu m);

(e) Provision and equipping of a workshop for permanent way material manufacturing and rehabilitation (list of equipment is shown in Table 3.8);

(f) Separation of road and rail at level crossings when road/rail traffic densities reach levels set by Government (50% of total costs carried by road authorities);

(g) Right-of-way improvements, stabilization of soils, drainage works, anti-erosion measures, security fencing, etc.; and

(h) Track maintenance equipment.

Motive Power and Rolling Stock

3.13 The main project items are:

(a) Provision of 30 main line diesel locomotives (calculated according to traffic forecasts, Reference C-3); provision of two breakdown cranes; repowering of about 59 diesel shunters and about 14 diesel railcars; and remodelling of about 40 heating cars;

(b) Provision of 34 special express cars and 145 limited express air-conditioned cars (as calculated, according to traffic forecasts, Reference C-4); provision of 19 power source cars for use with the special and limited express trains; provision of 13 dining cars (partly as renewals); remodelling of older existing cars for use as ordinary passenger and baggage cars; and

(c) Provision of 550 box cars and 870 gondola cars (calculated according to traffic forecasts, Reference C-5); remodeling of about 230 older box cars for use as cabooses, of about 130 flat cars for use as container cars, and improvement of about 1000 freight cars of different types.

Motive Power and Rolling Stock Repair Facilities

3.14 This part of the project comprises the following items:

(a) Provision of a new passenger car shop at Daejeon, to replace old and congested existing shops at Incheon and Yeongdeungpo; and

(b) Improvements to existing locomotive and car workshops and running sheds.

Telecommunications, Power Facilities and Miscellaneous

3.15 Items included are:

(a) Provision of telecommunication lines on the Yeong Dong Line (50 km) and Jong San Line (40 km), train radio equipment (about 310 sets at wayside stations and about 50 sets on trains), and about 10 train dispatcher units;

(b) Provision of power supplies (10 stations), lighting facilities (about 30 stations), emergency power line (Seoul electrified services), and power line improvements (about 400 km);

(c) Construction of housing for train crews and other employees (about 680 units);

(d) Provision of training equipment for KNR's training center and vocational training institutes; and

(e) Provision of continued technical assistance (estimated at about 70 man-months) in specific areas, such as technical and economic feasibility studies of major projects envisaged for 1980-81, accounting, and mechanical equipment maintenance.

## Cost Estimates

3.16 Project costs are based on estimated prices at the end of 1976 (Reference C-6), adjusted for price escalation and physical contingencies over the project period. The foreign currency cost of technical assistance, not including airfares and subsistence, is estimated at US$6,000-7,000 per man month. Physical contingencies of 10% have been included in the project for all items except motive power and rolling stock, rail and track renewal, track material workshop and track maintenance equipment. Price contingencies have been included for all items; assumed price increases for local currency items are 8% annually in 1977-1978, 7.5% in 1979 and 7% in 1980-1981; and for foreign currency items 8% annually in 1977, 7% in 1978, 6.5% in 1979 and 6% in 1980-1981. Contingencies, physical and price, on all items taken together represent about 19% of project cost.

## Financing Plan

3.17 Proposed financing of the foreign currency part of the project is given in Table 3.9 and summarized as follows:

| | Amount including contingencies (US$ million) |
|---|---|
| IBRD loan | 120.0 /a |
| Overseas Economic Cooperation Fund (O.E.C.F.) Japan | 3.2 |
| European consortium (50-cycle group) | 8.6 |
| U.S. Export-Import Bank plus US commercial banks | 39.7 |
| Suppliers' credits | 10.8 |
| Korean Foreign Exchange (KFX) - purchase by KNR | 7.9 |
| Total | 190.2 |

/a Includes US$0.50 million for financing transport sector studies (see para. 3.07).

## Project Implementation

3.18 KNR will be responsible for implementation of the project, with the exception of the transport sector studies, which will be directed by EPB. A project execution schedule and a procurement schedule for Bank financed items are given in Tables 3.10 and 3.11. Monitoring of progress based on these schedules will be further discussed during supervision. KNR's performance in executing the five previous projects has been in general satisfactory.

## Action Plans

3.19 The calculation of motive power and rolling stock requirements during the Investment Plan period is based on traffic forecasts given in Tables 2.5 through 2.7 and the following operational forecast:

| | Actual | Forecast | | | | |
|---|---|---|---|---|---|---|
| | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
| Availability of rolling stock (%) | | | | | | |
| Main line locomotives, diesel | 86.4 | 87.0 | 87.5 | 88.0 | 88.5 | 89.0 |
| Main line locomotives, electric | 84.6 | 85.0 | 85.5 | 86.0 | 87.0 | 88.0 |
| Passenger cars | 88.7 | 89.0 | 89.5 | 90.0 | 90.5 | 91.0 |
| Freight cars | 89.3 | 90.0 | 91.0 | 92.0 | 93.0 | 93.0 |
| Locomotive-km per available main line locomotive ('000) | | | | | | |
| Diesel | 152 | 173 | 174 | 174 | 175 | 175 |
| Electric | 118 | 120 | 122 | 124 | 127 | 130 |
| Passenger car-km per available passenger car ('000) | | | | | | |
| Special express coaches | 187 | 237 | 256 | 267 | 277 | 285 |
| Limited express coaches | 196 | 204 | 215 | 226 | 237 | 248 |
| Turnaround time for freight cars (days) | | | | | | |
| Box cars | 5.7 | 5.7 | 5.5 | 5.3 | 5.1 | 4.9 |
| Gondolas | 4.4 | 4.3 | 4.1 | 3.9 | 3.8 | 3.7 |
| Flat cars | 6.4 | 6.2 | 6.1 | 6.0 | 5.9 | 5.8 |
| Container cars | 3.8 | 2.5 | 2.4 | 2.4 | 2.4 | 2.3 |
| Average car load per loaded car (tons) | | | | | | |
| Coal | 45.0 | 45.3 | 45.4 | 45.5 | 45.6 | 45.7 |
| Cement | 45.4 | 45.6 | 45.7 | 45.9 | 46.0 | 46.1 |
| Ore | 43.9 | 44.3 | 44.5 | 44.7 | 44.9 | 45.1 |
| Oil | 42.0 | 42.2 | 42.4 | 42.6 | 42.8 | 43.0 |
| General cargo | 42.3 | 42.5 | 42.5 | 42.5 | 42.5 | 42.5 |

3.20 During negotiations agreement was reached that KNR will prepare, by December 31, 1978 a plan for achieving the operational forecasts indicated in para. 3.19, provided forecast traffic is offering. The measures to be included in such a plan are mainly:

(a) improvement of maintenance of locomotives and rolling stock through:

(i) implementation of the recommendations given by the technical advisor presently assisting KNR in establishing improved maintenance and rehabilitation schedules, including further reduction of the number of major running sheds;

(ii) provision of funds for spare parts, in accordance with the action plan agreed to under the Fifth Project (from 1978 on not less than W 2.2 billion annually for diesel locomotives, W 1.0 billion for passenger cars and W 1.5 billion for freight cars);

(iii) complete phasing out of steam locomotives;

(iv) concentration of passenger and freight car maintenance at the new workshops at Daejeon, and closing the existing workshops in Yeongdeungpo and Incheon; and

(v) improved training;

(b) continued attention to utilization of rolling stock in order to maintain the present trend of improvement.

3.21 The operational forecast given in para. 3.19, particularly for 1981, may be revised as a result of the management study to be carried out under Loan 1101-KO (para. 2.02).

## Procurement

3.22 All items to be procured under the proposed loan will be subject to international competitive bidding, in accordance with Bank guidelines. In bid evaluation, Korean manufacturers of equipment will be allowed a preferential margin of 15% of the c.i.f. cost of competing imports, or the relevant prevailing level of customs duties, whichever is lower.

## Disbursements

3.23 Disbursements would be made as follows:

(a) 100% of the c.i.f. cost of imported equipment and materials; and/or

(b) 100% of the ex-factory cost of locally manufactured equipment and materials if local bidders are successful;

(c) 100% of the foreign exchange cost of specialized technical assistance (para. 3.07);

(d) 100% of total cost for training and technical assistance (para. 3.15 (d) and (e)).

Any savings under the loan would be used for financing additional, but similar, project items, subject to review and agreement with the Bank.

3.24 An estimated schedule of disbursement is given in Table 3.12. Disbursements are based on the assumption that the proposed loan would become effective by June 15, 1978.

## 4. ECONOMIC EVALUATION

### General

4.01 KNR continues to play a vital role in the economy of Korea. While road transport and coastal shipping have increased their share of total transport demand over the last decade (para. 1.02), the railway remains the most economic mode of moving bulk commodities to inland destinations. The line haul costs are only a fraction of road costs and, while the costs of coastal shipping are competitive with rail costs on a ton-km basis, the circuitous sea routes around the peninsula often give rail the advantage. The traffic forecasts given in Chapter 2 have taken into consideration competition from other modes, particularly from coastal shipping for bulk movements of cement, oil and fertilizer from plants located on the coast. However, for coal and most cement, which account for over 50% of railway ton-km, the major production areas are inland. It is imperative that rail capacity be at all times sufficient to handle this traffic, which is vital for the country's continuous development (para. 4.07).

4.02 Regarding passenger traffic, the combination of increasing incomes and the government policy of restricting the use of private automobiles has led to a sharply increasing demand for the more comfortable and faster train services. Korea is indeed far behind most other countries in terms of private automobile ownership, despite its relatively high per capita income. The 70,000 private cars presently in Korea amount to only 2 per 1,000 persons. The ratios are 2.6 in Indonesia, 7.7 in Thailand, 10.6 in the Philippines and 37.4 in Malaysia. Only the latter has a higher per capita income than Korea. For long distances in the 300-400 km range, such as Seoul-Busan (445 km), Seoul-Gwangju (371 km) and others, express trains offer more comfortable, safer and slightly faster trips than highway buses. Special express trains also compete favorably with air travel on the Seoul-Busan route. The price is about half and the time is comparable when terminal transport between airports and city centers is taken into account. In view of the above, it appears well justified to develop express train services to satisfy the fast increasing demand, particularly since these are the most profitable services of KNR. Operating ratios for the special and limited express services were, respectively, 63 and 66% in 1977. Traffic forecasts are given in Chapter 2.

## Benefits and Economic Returns

4.03 The investment analysis has focused on the last four years of the 1977-81 FFYP. Investments starting in 1978 and 1979, which form the proposed project, are analyzed in detail below. Investments starting in 1980-81 are presently indicative of the order of magnitude of the need. Detailed technical and economic justifications for the major investment items will be prepared before the end of 1979 (para. 3.03).

4.04 The economic evaluation focuses on project investments globally, and on particular items whenever possible. Table 4.1 shows project investments classified for the purpose of economic analysis. The larger group, about 62% of all project costs, consists of investments which are primarily geared to increase the capacity of the railway to carry traffic for which rail transport is the most economic way of satisfying transport demand. The remaining project items consist of: (a) way and structures renewals 10%; (b) investments in the Seoul suburban rail system (SMESRS) 7%; (c) a new central passenger car workshop at Daejon 5%; and (d) miscellaneous investments 16%. Items in (b) and (c) above are subject to further review following completion of studies now in progress. No economic return has been calculated on these items because of lack of appropriate cost benefit data, although there is enough evidence to support their tentative inclusion in the project.

### Capacity Increasing Investments

4.05 These investments are basically of two types: fixed installations on the lines, and motive power and rolling stock. The latter can, of course, be used more flexibly throughout the network than the former, and thus have a lower risk factor than line installations. Consequently, line capacity investments have been very carefully analyzed on a line-by-line basis. Existing capacity has been estimated, and ways to increase it through improved operations discussed extensively with KNR. The Bank also retained consultants Rapp A.G. (Switzerland) to apply a line capacity model on two of the lines for which KNR planned sizeable fixed investment: namely, a section of the Jung Ang line (64 km from Jecheon to Yeongju) which was proposed for electrification, and the Donghae-Nambu line (Busan-Pohang), on which KNR proposed to install CTC, new crossing loops, stations, and marshalling yards. Application of the model, which uses an "interactive graphic" approach, indicated that in both cases it would be possible to reach a practical capacity at least 10% above the level of the present timetable without major investments (Reference B3). The consultants also identified some low cost measures which would further increase practical capacity, without yet engaging the larger proposed investments. As a consequence, electrification of a section of the Jung Ang line and CTC on the Donghae-Nambu line was postponed for a few years, and KNR was asked to further review its justification (para. 3.03). Where traffic demand forecasts still exceeded possible line capacity, the analysis focused on the least cost investments to increase it. For instance, by adding as many crossing stations as possible on a single track line, instead of installing either expensive

signalling systems or double tracking. As a result, line capacity investments in the project period were reduced by about US$40 million from the original investment plan proposal, and now represent only 15% of total project costs.

4.06 Capacity in motive power and rolling stock has been analyzed on a network-wide basis. Careful consideration was given to possibilities for increasing operating performance, such as train-km for locomotives and turnaround times, loadings, and distances traveled for wagons. For the purpose of rate of return calculations, capacity-increasing investments have been allocated to freight and passenger services. This was done directly in the case of freight and passenger cars, and for some fixed investments. In the case of locomotives and joint fixed investments on lines - such as crossing loops, bypass lines and signalling - allocation was in proportion to the relative capacity provided for each service (Table 4.2).

4.07 Freight - The benefits of investments to increase the railway's capacity in carrying freight traffic are measured in terms of transport cost savings for the economy of the country. They are calculated as the difference between the economic cost of rail transport and the economic cost of the next best alternative mode. The major variables involved in the calculation of benefits are: (a) the amount of traffic that would be diverted to other modes based on the capacity of the railway with and without the project; and (b) the economic costs of tansport by various alternative modes (Table 4.3). Alternative modes could be road, or a combination of either rail or road and coastal shipping. As mentioned in para. 4.01, rail traffic forecasts already reflect the share of coastal shipping when it is the most economic mode; i.e. for traffic having origins and destinations at, or very near, the coast. For the remaining traffic, for which rail capacity is provided by the proposed project, coastal shipping is no longer a valid alternative, as it would involve long terminal transport at either end, which would require either rail capacity or the higher cost road transport. Consequently, in this analysis, rail costs are compared to road costs, as the costs of an alternative using coastal shipping for part of the way are even greater than the all road alternative. The economic benefits in terms of transport cost savings would yield an economic rate of return (ERR) of over 40% (Table 4.4). This is a conservative estimate, since the amount of traffic that would divert to other modes without the project has been assumed at only 60% of the traffic increase forecast for 1978 and 1979; i.e. equivalent to the capacity provided by new cars acquired under the project. The remaining 40% of anticipated traffic growth will be handled by conversion and improved utilization of existing cars. No benefits have been attributed to this traffic, since the costs are small and most of the benefits should accrue even without the project.

4.08 Passengers. The proposed capacity increases are for the better quality services provided by KNR: the special and limited express trains. No capacity increase is provided for ordinary trains. The economic cost of these better services is comparable to that of the air-conditioned expressway buses. Rail fares for these services, however, are substantially higher than either rail costs or bus fares; 91% higher than costs for special express and 72% higher than limited express (Table 4.5). The fact

that people are ready to pay twice as much as the bus fare to travel on the special express trains reflects the benefits they derive from such service: e.g. comfort, speed, lesser accident risk, etc. Consequently, benefits of increasing the capacity of the better passenger services are measured in terms of willingness to pay for the service over and above their costs. They are calculated as the difference between the cost of the services and their revenues, and give a return of 17% on the investment (Table 4.6).

Way and Structures Renewals

4.09 The main items in this category are rail and track renewal, including sleepers replacement and new ballast. The remainder of the cost is for strengthening of bridges and tunnels. While it is a general practice of railways to show way and structure renewal costs in their investment programs, the nature of these costs is more periodic maintenance than investment. Rail and sleepers have to be periodically replaced, and ballast has to be added in order to keep the trains operating safely at normal speeds. The program submitted by KNR for implementation during the plan and project period was examined on the basis of the age and characteristics of rail, track, and traffic on a particular line.

4.10 KNR's network consists of 4,100 km of track. Some 930 km or 23% of the network, have rails over 20 years old; another 880 km have rails between 10 and 20 years old. In terms of traffic, rail renewal timing can be related to the number of gross tons which have passed over a given line section. This is only broadly indicative, as conditions will vary widely from one line to the other as a function of topography, alignment, and train types. Assuming, however, that the useful rail life is on average around 300 million gross tons, there would be some 1,000 km (24% of the network) on which rail life would be between 10 and 20 years, and another 250 km with a 20-30 year life (based on 1976 traffic volumes). For the rest of the network, rails would last up to 40 and 50 years. On the basis of the above assumed rail life for various sections of the network, renewal should average about 140-150 km/year. This figure would increase over time, as traffic growth shortens rail life.

4.11 The rail and track renewal program discussed with KNR, and confirmed during negotiations, would cover the recurrent need and also some of the urgently needed rail replacement in curves on the industrial lines. If this program was not carried out, the quality of the track would deteriorate, with the risk of increased accidents. Speed restrictions needed to ensure safety would gradually reduce capacity, particularly on single track lines which account for most of KNR's network. In calculating line capacity as described in para. 4.05, it was assumed that track conditions would not be allowed to deteriorate and that speeds would be maintained at least at their present levels. To prevent track deterioration without the proposed rail and track renewal program would require increased maintenance. On the basis of maintenance costs savings, rail renewal on the 8 lines included in the project would yield ERRs ranging from 20% on the line with the lowest traffic (6 million gross tons p.a.) to 32% on the line with the highest traffic (25 million gross tons p.a.), with a weighted average of 27% (Reference C-7).

Seoul Suburban Lines

4.12 The city of Seoul now has over 7 million inhabitants. Furthermore, urban development has spread beyond the city boundaries along the transport lines. Cities such as Incheon (800,000), Anyang (135,000) and Suweon (225,000) to mention only the larger ones on the rail lines, are growing rapidly; thus creating with Seoul an interconnected urban system of some 9 million people. Until 1974, urban transport consisted almost exclusively of buses and taxis. Because of the configuration of the center of Seoul, which includes large blocks penetrated by narrow streets suitable only for pedestrians and small delivery vehicles, traffic congestion on the major arteries is acute despite the very low rate of private car ownership (para. 4.02).

4.13 In 1974, the first sections of a mass rail transit system were put into service, consisting of a 9.5 km underground line (Seoul City Subway) and 86 km of electrified existing KNR lines (MAP). The system met with immediate success and acceptance by the public, carrying over 130 million passengers in 1976. For the first half of 1977, traffic was 40% above that in 1976. The city of Seoul is considering further extensions of the subway but, because of the high cost of subway lines no final decision has been made. Meanwhile, KNR proposes to upgrade about 63 km of existing lines with electrification and some double tracking, in order to expand suburban services. There is no doubt that, given the densities of urbanization in Seoul, there is a good case for making the maximum use of existing rail infrastructure and right of way. Costs of upgrading existing rail lines are small compared to subway construction. However, to derive maximum benefit from the investment, it is necessary to analyze in detail potential transport demand in the corridors in which KNR proposes to expand service, to forecast traffic in relation to other modes, ensure the optimum location of stations, and confirm the order of priority and timing of construction of the various sections. A comprehensive urban transport study of the larger Seoul Metropolitan Area was started in July 1977 by the Transportation Economic Group of the Korea Institute of Science and Technology (KIST). It is expected to take about one year to complete and would answer the above questions. It was agreed during negotiations that KNR would postpone investment on the suburban lines until the results of the study become available. Meanwhile, the proposed investments are included in the project, although none of the loan funds will be applied to them.

Daejon Passenger Car Workshop

4.14 KNR has decided to consolidate its passenger car maintenance at Daejon, a central location on the two most heavily traveled lines: from Seoul to the Southeast (Busan) and to the Southwest (Gwangju-Mogpo). Existing workshops, particularly those at Seoul and Incheon, are old and crowded. Urban development prevents their extension and access is difficult in view of the intensive use of the Seoul area lines for frequent urban services. Studies for the proposed Daejon workshop have recently

been completed and will be reviewed by the Bank prior to the start of construction.

Miscellaneous

4.15 This category, comprising some 16% of the project cost, almost all in local currency, includes numerous small investments dispersed over the entire network. The largest amount, about a third of the total, is for improving safety at rail and road intersections. This ranges from simple signalling, to level crossing barriers and grade separation where justified by higher traffic volumes. The cost of these safety measures is shared equally between KNR and the Ministry of Construction (MOC). The locations of these improvements are selected jointly by KNR and MOC, according to established rules, based on respective levels of traffic on rail and on the intersecting road. Other items include improvement of existing backshops and sheds, relocation of lines to accomodate new industrial and urban developments, and general improvements to right of way, buildings, housing and training facilities.

Overall Economic Evaluation

4.16 The average economic return on the capacity increasing investments and on way and structure renewals, which account for 72% of total project costs, is 30%. This rate of return excludes the investments in: (a) the SMESRS lines and Daejon Workshop, for which studies are still underway (para. 4.12 to 4.14), totalling 12% of project costs; and (b) miscellaneous small investments dispersed over the entire network (para. 4.15), totalling 16% of project costs.

## Sensitivity and Risks

4.17 As previously mentioned (para. 2.21), traffic forecasts for railway projects have often been over-optimistic. This is the main area of risk. However, in an economy growing as rapidly as Korea's it is only a matter of time for the forecasts to be achieved. Thus, full project benefits are realized at most one or two years later than expected. For the purpose of sensitivity analysis, the ERR's of the capacity increasing investments have been recalculated assuming that both freight and passenger traffic would increase at 50% of the forecast between 1977 and 1981. This same assumption is used for the sensitivity analysis in the financial evaluation (para. 5.27).

4.18 Estimated costs for Korea railway projects have typically been realistic, and slightly on the high side, as illustrated by the funds remaining in previous loans after the projects have been fully executed. For the sensitivity analysis, the ERRs of the capacity increasing investments have been recalculated with cost variations of $\pm$ 10%. The results of sensitivity analysis are given in the table below:

ERR IN PERCENT

| | Best estimate | Sensitivity: Traffic growth 50% | Sensitivity: Cost +10% | Sensitivity: Cost -10% |
|---|---|---|---|---|
| Capacity increasing investments | | | | |
| Freight | 42 | 30 | 37 | 49 |
| Passenger | 17 | 15 | 15 | 19 |

4.19 As expected, the impact of even substantially slower traffic growth on the rate of return is not very large, since benefits are postponed but not cancelled. Another risk which is, however, impossible to quantify and time, relates to passenger services. As mentioned in para. 4.02, the high demand for better quality trains is related to low private car ownership. Should government policy change, passenger traffic would certainly be negatively affected. However, the effect of increased car ownership would spread over a period of years and may be tempered by overall growth in transport demand. Since railway equipment has a long life (assumed at 25 years for the ERR calculation), it is important to closely monitor shifts in demand for rail services in order not to be saddled with excess capacity.

## 5. FINANCIAL EVALUATION

### General

5.01 With heavy passenger and freight traffic, generally efficient operations and low unit costs, KNR has the potential to become a financially viable enterprise. Revenues could be sufficient to cover operating expenses, debt service and a reasonable proportion of its capital investment needs. KNR earned annual profits through 1969, although the amounts were relatively modest and, due to inadequate depreciation provision and maintenance expenditures, its profits were overstated.

5.02 As explained in para. 2.28, tariffs are strictly regulated by the Government, which has held freight rates at low levels. As a result after 1970 - with rising cost levels inflating KNR's operating expenses, and the Government reluctant to permit adequate railway tariff increases (para. 5.06) - the situation changed. KNR has since sustained regular annual net deficits.

5.03 Reduced earnings, together with Government refusal to provide equity capital (other than operating subsidies commencing in 1972), have forced KNR to finance most of its investment requirements by borrowing.

This has increased its debt service burden, further reducing available funds, and even causing KNR to borrow from the Korean Development Bank funds needed to cover debt service.

5.04 Rates could be substantially raised on most of KNR's major freight traffic (coal, cement, fertilizer, ores, grains and oil) with little fear of significant diversion to other transport modes. In view of KNR's continual efforts to improve passenger services (introducing new equipment and providing more frequent services), passenger fares could also be raised (para. 2.33). Thus, it should be possible for KNR to achieve financial viability, provided the Government takes the needed action on tariffs.

## Past Financial Performance

5.05 Income statements for the years 1971 through 1977 are given in Table 5.1 and are summarized below:

| | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 /b |
|---|---|---|---|---|---|---|---|
| | (W billion) | | | | | | |
| Total operating revenues | 31.2 | 36.5 | 41.6 | 53.0 | 75.6 | 102.6 | 135.1 |
| Less: Total cash expenses | 27.8 | 29.8 | 34.0 | 48.9 | 68.2 | 97.6 | 118.0 |
| Depreciation | 4.0 | 4.5 | 4.9 | 5.2 | 6.5 | 15.0 | 17.4 |
| Total operating expenses | 31.8 | 34.3 | 38.9 | 54.1 | 74.7 | 112.6 | 135.4 |
| Net operating revenue (loss) | (0.6) | 2.2 | 2.7 | (1.1) | 0.9 | (10.0) | (0.3) |
| Less: Interest charges | 3.3 | 5.5 | 6.5 | 7.4 | 10.4 | 15.1 | 20.3 |
| Net railway revenue (loss) | (3.9) | (3.3) | (3.8) | (8.5) | (9.5) | (25.1) | (20.6) |
| Add: Other revenue (expense) net /a | (0.7) | (7.6) | (3.3) | (23.2) | 5.4 | 1.7 | 0.5 |
| Net revenue (loss) | (4.6) | (10.9) | (7.1) | (31.7) | (4.1) | (23.4) | (20.1) |
| Add: Government Subsidy (cash) | - | 0.7 | 1.5 | 5.7 | 14.4 | 13.7 | 21.7 |
| Net income (adjusted) | (4.6) | (10.2) | (5.6) | (26.0) | 10.3 | (9.7) | 1.6 |
| Operating ratio (%) | 102.0 | 94.0 | 93.5 | 102.0 | 99.0 | 110.0 | 100.0 |
| Interest charge coverage (times) | - | 0.3 | 0.4 | - | 0.1 | - | - |
| Debt service coverage (times) | 0.3 | 0.5 | 0.5 | 0.7 | 0.3 | 0.4 | 0.5 |
| Return on net fixed assets (actual) | - | 0.9% | 1.1% | - | 0.1% | - | - |
| Return on net fixed assets (required) | | | | | | | |
| (a) Under Loan 669-KO | 7.0% | 7.0% | 7.0% | - | - | - | - |
| (b) Under Loan 663-KO | - | - | - | - | 2.0% | 3.0% | 3.0% |
| (c) Under Loan 1101-KO | - | - | - | - | - | 2.0% | 3.5% |

/a Includes losses or gains on foreign currency fluctuations.
/b Tentative figures, based on 11 months actual results.

5.06 This table shows that because tariff increases generally have been inadequate and too late, KNR has been unable to generate sufficient revenues to cover debt service requirements (which have risen from W 8.8 billion in 1971 to W 23.2 billion in 1976), or to earn agreed rates of return. The Government recognizes this, but has maintained it would be inflationary to raise railway freight tariffs to a level sufficient to cover fully distributed costs. Consequently, to compensate for the loss in revenues due to delayed or inadequate freight rate increases, the Government commenced, in 1973, to pay a subsidy to KNR. This subsidy rose from W 1.5 billion in 1973 to W 14.4 billion in 1975, declined slightly to W 13.7 billion in 1976, and increased to W 21.7 billion in 1977.

5.07 Confronted with this Government policy regarding freight tariffs, KNR has tended to rely on passenger service profits to offset losses on freight services. Until recently, average revenue per passenger-km has been higher than revenue per freight ton-km (Table 2.14). However, this has tended to make railway passenger service more vulnerable to highway competition; in fact, KNR's passenger-traffic declined by 17% from 1969 to 1971. Since 1973, as seen in Table 2.14 the Government has allowed freight tariffs to increase more rapidly than passenger fares. The result has been that, by 1976, average revenue per ton-km exceeded that per passenger-km. The slower increase in passenger fares, and improvements to passenger services, have resulted in a reversal of the downward trend in passenger-km, which have increased by 68% since 1971.

5.08 Table 5.2 illustrates the effects of inflation on revenues and costs. Average revenues per passenger-km increased in current won from W 1.976 in 1970 to W 3.673 in 1976, but declined in real terms to W 1.313. Average revenues per ton-km increased in current won from W 1.44 in 1970 to W 4.636 in 1976, but declined in real terms to W 1.107 in 1974 (this has since improved to W 1.657 in 1976).

5.09 Costs rose significantly in 1976, due largely to a mandatory wage award, and for KNR to have covered its debt service obligations, operating revenues would have needed to be increased by about 15%; i.e. the increase in freight tariffs granted in January 1976 should have been matched by a similar increase in passenger fares. As noted in Table 2.12, freight rates were raised in January 1977 by the restructuring of the freight tariff, but there was no increase in passenger fares. The freight rate increases ranged from 16% for the previous class 2 to 27% for the lowest class (mainly coal). Tentative results for 1977 indicate that KNR almost broke even on operations. Freight revenues, aided by the tariff increases noted above, rose from W 43.5 billion in 1976 to W 59.5 billion in 1977, and passenger revenues, due to increased traffic rose from W 52.5 billion in 1976 to W 66.7 billion. The net deficit, after interest charges, of W 20.1 billion was more than covered by the government subsidy of W 21.7 billion.

5.10 KNR's balance sheets for the years 1971-76, given in Table 5.3, are summarized below:

| | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 |
|---|---|---|---|---|---|---|
| | (W billions) | | | | | |
| Current assets | 11.7 | 7.7 | 9.9 | 11.3 | 20.3 | 29.4 |
| Less: Current liabilities | 16.4 | 19.6 | 18.3 | 22.1 | 13.9 | 15.3 |
| Net working capital (deficiency) | (4.7) | (11.9) | (8.4) | (10.8) | 6.4 | 14.1 |
| Net fixed assets /a | 196.5 | 229.8 | 340.6 | 370.7 | 410.4 | 790.9 |
| Other assets | 46.3 | 4.5 | 6.5 | 6.0 | 0.1 | 0.1 |
| Total assets | 238.1 | 222.4 | 338.7 | 365.9 | 416.9 | 805.1 |
| Long term liabilities | 75.3 | 80.5 | 100.5 | 154.6 | 194.5 | 245.1 |
| Other liabilities | - | 1.0 | 1.3 | 1.7 | 1.9 | 3.3 |
| Net equity /a | 162.8 | 140.9 | 236.9 | 209.6 | 220.5 | 556.7 |
| Total debt and equity | 238.1 | 222.4 | 338.7 | 365.9 | 416.9 | 805.1 |

/a Include effect of revaluation of assets in 1973, (land only), and in 1976 (all assets including land).

5.11 As shown by the above table, KNR's working capital position, which had steadily deteriorated until 1974, has improved. This is largely because the Government paid considerable operating subsidies to KNR in 1975 and 1976. However, the long-term debt has risen sharply over the period, from W 100 billion in 1973 to W 245 billion at the end of 1976.

5.12 The Fifth Railway Loan Agreement reaffirmed the debt limitation covenant of the Fourth Railway Loan Agreement, which required the Bank's agreement before KNR incurred any debt should KNR's net cash revenues be less than 1.2 times the maximum debt service requirements. KNR's net cash revenues have not been sufficient to achieve this ratio, and the outstanding debt has continued to grow, with a consequent rise in debt service requirements. The increase in the outstanding long-term debt referred to in para. 5.11 was largely due to: (a) the drawing down of loans already negotiated, such as IBRD loans 863 and 1101-KO, O.E.C.F, KFW, Eximbank and 50 c/s group /1 loans,

/1 European manufacturer's consortium.

which rose by W 84 billion; and (b) the increase in borrowing from the KDB, for capital investment and to help finance KNR's growing annual debt service (para. 5.03). The debt limitation covenant was re-affirmed at negotiations.

5.13 The total debt outstanding at the end of 1976 is given in detail in Table 5.4, and is summarized below:

| Type of loan or finance | Amount outstanding (US$ million) | Equipment financed |
|---|---|---|
| 50 c/s Group (European Consortium) | 51.1 | Electrification (locomotives and fixed equipment) |
| US Exim Bank and Commercial Banks | 35.1 | Diesel locomotives and engines |
| IDA credits and IBRD loans | 161.6 | Miscellaneous equipment |
| O.E.C.F. (Japan) | 67.1 | Miscellaneous equipment |
| U.S.A.I.D. | 15.0 | Miscellaneous equipment |
| Suppliers credits and foreign loans | 15.3 | Miscellaneous equipment |
| Total Foreign Finance | 345.2 | |
| Korean Development Bank (KDB) | 158.1 | US$ equivalent of local expenditures in Won |
| Total | 503.3 | (Equivalent to W 244.1 billion) |

5.14 In a side letter to the Fifth Railway Loan Agreement dated April 10, 1975, the Government undertook to provide KNR with the funds needed to service debt, until such time as KNR's cash generation became sufficient for this purpose (which should not be later than Fiscal 1980). During 1975 and 1976, such funds were provided by the Government in the form of further borrowing from the KDB. In the same letter, the Government also undertook to formulate a financial recovery plan designed to enable KNR to generate revenues sufficient to cover its operating expenses, meet its debt service obligations in full and make a contribution towards its capital investments. The elements, and effects, of such a plan are discussed in paras. 5.16 - 5.21.

5.15 As agreed under the Fifth Railway Loan, KNR carried out a revaluation of fixed assets in 1975/76, the results of which are reflected in the balance sheet of December 31, 1976. This revaluation added W 470 billion to the gross value of fixed assets (including W 97 billion for land), and resulted in a rise in annual depreciation provision from W 6.5 billion in 1975 to W 15.0 billion in 1976. A further revaluation done in 1977, using cost indices, added W 25.7 billion to the gross value of fixed assets. KNR has agreed to revalue its fixed assets on an annual basis.

## Forecast Financial Performance (1978-81)

5.16 KNR has prepared financial forecasts, based on assumptions and data detailed in Table 5.5. These forecasts have been adjusted to take into account tariff increases proposed by the Government, and are given in Tables 5.1, 5.3 and 5.6. The proposed increases, which would enable KNR, after 1978, to generate funds sufficient to cover debt service requirements, and make some provision towards capital investment needs are listed below:

| Proposed tariff increases | Passenger | Freight |
|---|---|---|
| 1978 | 10% | 15% |
| 1979 | 10% | 15% |
| 1980 | 10% | 15% |
| 1981 | 10% | 10% |

The Government has proposed the tariff increases listed above in the light of its policy to restrict inflation within a limit of 10% annually. Thus passenger fares would keep pace with inflation, and KNR's freight revenues would improve by about 5% annually in real terms. The proposed tariff increases are lower than those suggested by the Bank; to compensate for the reduced revenues the Government also proposes to grant subsidies to KNR of W 14.6 billion (1978), W 12 billion (1979) and W 7.5 billion (1980).

5.17 The methodology and principal assumptions are summarized below:

(a) Income accounts

(i) Revenues: Based on agreed traffic forecasts, converted to revenues by applying average 1977 revenues per pass-km or ton-km. The effect of tariff increases is shown separately. Other minor increases are due to a Management Rationalization Plan (MRP) KNR is carrying out.

(ii) Operating Expenses

a. Labor costs take into account some minor increases in staff, plus forecast 11-12% average annual cost increases.

b. Fuel costs are based on estimated engine-km (derived from traffic forecasts), plus forecast 7.5-8% average annual cost increases.

c. Maintenance costs include labor costs calculated as in (a) above, materials costs adjusted for traffic increases and for cost increases as in (b) above.

d. Other costs are based on the 1977 level, inflated as in (b) above.

(iii) Depreciation is calculated at 2.4% of the annual value of gross fixed assets, excluding land. Calculations include the effect of proposed annual revaluations.

(iv) Interest charges: Forecast on the basis of: existing debt, plus new foreign debt at 8% p.a. (largely repayable over 17 years, including 4 years grace); and new local borrowing at 6% p.a. (repayable over 20 years with 5 years grace, as presently obtained from the KDB).

(b) Balance sheets

- Receivables vary largely with freight traffic;
- Inventories vary with total operating costs;
- Accounts payable vary with cash operating costs; and
- Fixed Assets take into account (i) investment proposed under the Investment Plan; (ii) annual retirements or disposal of assets at about 10% of annual investment, (iii) annual revaluations at 8% for the years 1977-79, and 7.5% for 1980 and 1981.

(c) Detailed calculations are available in the Project File (Reference C-8).

5.18 Overall, the projections show an improved financial performance. The actions proposed would enable KNR to maintain a satisfactory working capital position. However, it would be unable to contribute anything toward capital investment requirements of W 202 billion needed over the project period (1978/79) but would be able to contribute W 33 billion towards overall investment plan requirements of W 503 billion; the Government is expected to provide about W 76 billion in subsidies and grants, and about 78% (W 394 billion) of the investment plan would have to be borrowed (para. 5.20). Long-term debt would thus rise from W 245 billion at the end of 1976 to W 533 billion by the end of 1981 (Table 5.3).

5.19 The 1978-81 income account forecast, given in Table 5.1 is summarized below.

| | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|
| | (W billion) | | | |
| Operating revenues | 158.8 | 196.6 | 235.7 | 273.2 |
| Operating expenses | 155.8 | 174.6 | 192.9 | 213.8 |
| Net operating revenue (loss) | 3.0 | 22.0 | 42.8 | 59.4 |
| Interest charges | 22.0 | 28.5 | 33.5 | 37.7 |
| Other revenues/expenses (net) | 1.0 | 1.3 | 1.5 | 1.8 |
| Net revenue (deficit) | (18.0) | (5.2) | 10.8 | 23.5 |
| Operating ratio (%) | 98 | 89 | 82 | 78 |
| Interest charge coverage | 0.1 | 0.8 | 1.3 | 1.6 |
| Debt service coverage | 0.7 | 1.1 | 1.4 | 1.6 |
| Return on net fixed assets | 0.3% | 2.1% | 3.5% | 4.2% |

The operating ratio would improve from 110 in 1976 to 78 by 1981; the interest charge coverage would rise from negative in 1976 to 1.6; the debt service coverage would improve from 0.4 in 1976 to 1.6, and KNR would earn a rate of return of 0.3% in 1978, improving to 4.2% in 1981. While the latter is relatively modest, further improvement would require raising tariffs higher than as proposed, which would conflict with the Government's policy of inflation restraint (para. 5.16).

5.20 The cash flow forecast for the project period (1978/79),/1 and for the investment period (1977-81) (detailed in Table 5.6), is summarized below:

/1 Some project investment will spread over into the years 1980-81.

| | | Project period 1978/79 | Investment plan period 1977-81 |
|---|---|---|---|
| | | (W billion) | |
| (i) | From KNR | | |
| | Cash generated by KNR /a | 73.7 | 260.7 |
| | Less: Debt service | 80.5 | 229.9 |
| | | (6.8) | 30.8 |
| | KNR's working capital - add | (0.5) | - |
| | - from | - | 1.9 |
| | Net cash available from KNR for investment | (7.3) | 32.7 |
| (ii) | Equity | | |
| | Funds from Government for operations and investment | 34.1 | 76.1 |
| (iii) | Borrowing - IBRD loan | 52.1 | 57.9 |
| | - Other foreign | 37.0 | 153.4 |
| | - Local (KDB) | 86.5 | 182.8 |
| | Subtotal borrowing | 175.6 | 394.1 |
| Funds needed for investment | | 202.4 | 502.9 |
| Funds provided by KNR | | (3.6%) | 6.5% |
| Funds provided by Government | | 16.8% | 15.1% |
| Funds needed from borrowing | | 86.8% | 78.4% |

/a Includes non-operating and other revenues.

KNR will not be able to contribute to the project cost, and with the Government providing equity funds of about 17%, KNR will have to borrow the remaining funds needed. KNR's earning power will improve in later years, and its dependence on the Government and on the need to borrow for investment will decline. Thus over the whole investment plan period (1977-81) KNR would be able to contribute about 7% of the total cost, the Government share would deline to 15% and borrowing would account for 78%.

5.21 Forecast balance sheets for the years 1977-1981 are summarized below:

| | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|
| Current assets | 29.1 | 32.5 | 36.9 | 43.7 | 48.6 |
| Less: current liabilities | 20.2 | 23.6 | 27.5 | 29.9 | 33.0 |
| Net working capital | 8.9 | 8.9 | 9.4 | 13.8 | 15.6 |
| Net fixed assets | 842.0 | 982.7 | 1,160.2 | 1,341.5 | 1,528.2 |
| Other assets | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |
| Total assets | 858.3 | 999.0 | 1,177.0 | 1,362.7 | 1,551.2 |
| Long-term debt | 275.0 | 340.3 | 420.6 | 482.8 | 533.0 |
| Provision for severance pay | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 |
| Net equity | 580.0 | 655.4 | 753.1 | 876.6 | 1,014.9 |
| Total liabilities and equity | 858.3 | 999.0 | 1,177.0 | 1,362.7 | 1,551.2 |

Current and liquid ratios should be about 1.4 and 0.8, respectively, after 1977. The debt/equity ratio should rise from 29/71 in 1976 to 36/64 in 1979, then fall to 35/65 by 1981. These ratios would be satisfactory.

5.22 A financial recovery plan, agreed on at negotiations included the following points:

(a) the aggregate of tariff increases in any fiscal year will be not less than the increase in the wholesale price index in Korea for that year;

(b) the earning by KNR of a rate of return of not less than 2% in fiscal year 1979, 3.2% in fiscal 1980 and 4% annually thereafter;

(c) the funds needed to finance debt service (para. 5.14) will be provided by way of grants or equity contributions;

(d) tariff increases acceptable to the Bank will be made before loan effectiveness.

## Sensitivity Analysis

5.23 Experience with most railway projects has shown that forecasting traffic presents the greatest difficulty. With few exceptions, project appraisal forecasts have been overly optimistic, particularly for freight.

5.24 In Table 5.7, 1972-76 freight and passenger traffic, forecast in appraisal reports for Loans 863-KO and 1101-KO, are compared with actual results. As the forecasting periods of the two reports overlap, there is some duplication. In general, the forecasts for Loan 1101-KO were more optimistic than those for 863-KO.

5.25 For Loan 1101-KO, actual freight ton-km rose at 50% of the rate forecast; actual passenger traffic (in pass-km) rose at 73% of the rate forecast. For the purposes of a sensitivity analysis, it is assumed that both freight and passenger traffic will increase over the years 1977-81, at 50% of the rate forecast.

5.26 Another risk relates to the adequacy of tariff increases granted by the Government. As discussed in para. 5.06, tariff increases, due to the Government's reluctance to take such action, have been generally granted too late and too small. The financial forecasts given in this chapter have assumed tariff increases as now proposed by the Government. Should the actual tariff increases fall short of these, then the effect of such action is shown in Table 5.8.

5.27 Table 5.8 presents the effects of three alternatives:

(a) Page 1. 50% reduction in traffic growth, with the Government's proposed tariff increases;

(b) Page 2. No reduction in traffic growth, with 50% of the Government's proposed tariff increases after 1978; and

(c) Page 3. 50% reduction in traffic growth, with 50% of the Government's proposed tariff increases after 1978.

5.28 Only in alternative (a) would KNR's cash generation be sufficient to cover debt service and make some contribution to investment. In all other cases, unless the Government continued to pay increasingly large annual operating subsidies, KNR would have to incur a much higher debt. This is illustrated by the table below:

| Additional Government subsidies needed (or additional borrowing) | 1978 | 1979 | 1980 | 1981 | Total 1978-81 |
|---|---|---|---|---|---|
| | | | (W billion) | | |
| Alternative (a) | 16.5 | 8.8 | - | - | 25.3 |
| Alternative (b) | 12.6 | 15.8 | 14.3 | 15.4 | 58.1 |
| Alternative (c) | 14.5 | 17.9 | 19.4 | 27.2 | 79.0 |

The rate of return under alternative (a) would be negative in 1978, rising to 2.6% by 1981; under (b) it would be 0.3% in 1978 rising to 1.0% in 1981, and under (c) it would be negative in 1978 rising to 0.5% in 1980 and falling to 0.2% in 1981.

5.29 The foregoing analysis emphasizes the importance of adequate tariff action. Slower traffic growth by itself would reduce cash generation, but KNR would still be able to finance debt service after 1979. Inadequate tariffs would only worsen the present unsatisfactory financial position of KNR.

5.30 The project's sensitivity to changes in (a) cost of the project and (b) level of operating costs was examined. Relatively generous price contingencies have been built into the estimated project costs (para. 3.16) and as further increases are not expected to be substantial, their effect is likely to be minimal, and has been disregarded. Regarding (b), as labor cost is the most significant, and has risen more sharply than other cost increases over recent years (Table 5.2, Item 3), the effect of annual increases of (i) 20% and (ii) 25% (as against annual increases of 12% assumed in the forcasts) was examined. The additional costs and the further annual tariff increases needed to generate the equivalent additional revenues are given below:

| | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|
| Additional labor costs (W billion) | | | | |
| (i) | 4.9 | 11.6 | 20.2 | 32.3 |
| (ii) | 8.0 | 19.2 | 34.3 | 55.5 |
| Additional annual tariff increases needed (%) | | | | |
| (i) | 3.0 | 2.9 | 2.4 | 3.0 |
| (ii) | 4.9 | 4.7 | 4.3 | 5.0 |

## 6. AGREEMENTS REACHED AND RECOMMENDATIONS

6.01 During loan negotiations satisfactory assurances were obtained from the Government on the following principal points:

(a) a management study of KNR will be carried out by June 1979 (para. 2.02);

(b) KNR will submit to the Bank, by mid-1979, detailed technical, financial and economic analyses of major fixed capacity investments proposed for 1980/81, such as double tracking, electrification and signaling (para. 3.03);

(c) transport sector studies will be carried out under the supervision of EPB, mainly by local consulting firms, with some specialized expatriate technical assistance (para. 3.07);

(d) KNR will establish a plan by end 1978 including measures necessary to achieve specific operational forecasts in 1979, 1980 and 1981 (para. 3.20);

(e) investment to upgrade Seoul suburban lines will be postponed until the results of the urban transport study of the larger Seoul metropolitan area become available (para. 4.13);

(f) construction of the proposed Daejeon passenger car workshop will not commence until the Bank has reviewed studies recently completed (para. 4.14);

(g) a financial recovery plan for KNR, (para. 5.22).

6.02 A condition for loan effectiveness is that KNR's freight and passenger tariffs have been increased to levels acceptable to the Bank (para. 5.22).

6.03 The proposed project is suitable for a Bank loan of US$120 million for a period of 17 years including 4 years of grace to the Government of the Republic of Korea, for onlending to the KNR.

KOREA

SIXTH RAILWAY PROJECT

Related Documents and Data Available in the Project File

A. General Reports and Studies on the Transport Sector

A-1 World Bank "Growth and Prospects of the Korean Economy" Annex F: Transport, Report No. 1489-KO

B. General Reports and Studies Relating to the Project

B-1 Terms of Reference for Management Study (para. 2.02)

B-2 Reports by CPCS's technical advisor for maintenance of rolling stock
- (a) Quarterly Report No. 1 dated January 3, 1977
- (b) Quarterly Report No. 2 dated April 15, 1977
- (c) Interim Report on Busan Shop dated April 30, 1977 (para. 2.14)

B-3 Consultants W.J. Rapp A.G. Basel, Switzerland. Application of the RAILNET Model to Elements of Korean Railroad Projects, Final Report and Appendices, Basel, September 20, 1977 (para 4.05).

C. Working Papers

C-1 Notes on the Forecast of Freight Traffic by Commodities (para. 2.20)

C-2 Review of KNR Rail and Track Renewal Program (para. 3.12)

C-3 KNR Locomotive Requirements 1977-81 (para. 3.13)

C-4 KNR Passenger Car Requirements 1977-81 (para. 3.13)

C-5 KNR Freight Car Requirements 1977-81 (para. 3.13)

C-6 Unit Prices for Project Items (para. 3.16)

C-7 Rail Renewal Program, Economic Evaluation (para. 4.11)

C-8 Detailed Calculations for Financial Projections (para. 5.17)

KOREA

SIXTH RAILWAY PROJECT

Major Covenants of Past Loan and Credit

Agreements - Degree of Compliance

1. The major covenants in the Loan/Credit Agreements relating to the five railway projects for which the Bank Group has provided financing fall into four main areas:

A. KNR's Status and Financial Autonomy
B. KNR's Financial Situation
C. Operational and Technical Matters
D. Transport Coordination

2. The specific covenants and the degree of compliance with them are detailed in the following paragraphs.

## A. KNR's Status and Financial Autonomy

### I. First Project - Credit 25-KO (August 17, 1962)

| Requirement | Degree of Compliance |
|---|---|
| Section 4.07 - The Borrower shall maintain, or cause to be maintained, separate accounts for the National Railroad adequate to reflect the expenditures and capital transactions of the National Railroad or attributable thereto. | Separate accounts are being maintained. |
| Section 4.08 - The Borrower shall employ competent and experienced consultants, satisfactory to the Association, upon terms and conditions satisfactory to the Borrower and the Association, to assist in carrying out the part of the Project described in paragraph (iii) of the Schedule hereto (installation of a statistical and accounting system in accordance with generally accepted commercial accounting practices). | Consultants (Booz, Allen and Hamilton Inc. - U.S.) were employed (Contract of April 8, 1963). In this connection see V on page 4. |

| | |
|---|---|
| Section 4.09 - Promptly after the establishment of the accounting and statistical system included in the Project, but in any case not later than December 31, 1964, the Borrower shall establish and thereafter maintain the National Railroad as a separate entity which, as an agency of the Borrower, will be responsible for the management, operation and development of the railroad facilities of the Borrower and will have such organization, financial resources and procedures and legal status and powers as are required to enable it to carry out its responsibilities efficiently and in accordance with sound business, financial and railroad practices. | KNR was established in 1963 as a separate entity, with an independent manager and its own budget and accounting system. |

II. Second Project - Credit 110-KO (December 18, 1967)

(i) Letter of December 18, 1967 re Organizational and Operational Policies

Organization and Budget

| | |
|---|---|
| KNR will be reorganized as a public corporation or other autonomous agency by the end of 1969. | KNR created as a semi-autonomous agency. Its powers were regarded as generally satisfactory by the Bank. |
| Management will exercise full authority over reallocations within budget, and | Not given, although as noted in the Appraisal Report on the Fourth Project, KNR had been given greater financial autonomy in financial matters since 1970/71. |
| in the meantime, Government will take immediate action on any request by DG of KNR regarding reallocation from one item to another in the Budget. | Such actions were taken. |

Budget System

| | |
|---|---|
| KNR will adopt the performance budget system as recommended by the consultants appointed under Cr. 25-KO. | Not done. Not practically possible while KNR operates existing Government form of Budget. |

Staff

| | |
|---|---|
| Limitation of numbers, and of converting temporary staff to permanent status. | Done |

(ii) Letter of December 18, 1967 regarding Consultants

Consultants

| | |
|---|---|
| KNR to employ consultants to provide assistance on statistics, traffic costs and tariffs, rolling stock maintenance, marshalling yard requirements and review of uneconomic lines. | Consultants employed Ross and Co., Canada August 1969, and studies completed. |

III. Third Project - Credit 183-KO (May 14, 1970)

| | |
|---|---|
| Section 4.06 (b) (i) KNR to maintain accounts solely in accordance with the commercial accounting system, and to cease to maintain them as hitherto, not later than January 1, 1976. | Not done, adequate trained accounting staff for the implementation of the commercial accounting system was not available (see IV and V on pages 3 and 4). |
| Section 4.06 (b) (ii) Installation of performance budgeting system by December 31, 1973. | Not done, see item II above. |
| Section 4.21 Director-General of KNR to be given, not later than June 1, 1970, power to reallocate funds within the budget. | Increased powers were delegated to KNR's Director-General in mid-1970. |

IV. Fourth Project - Loan 863-KO (November 22, 1972)

| | |
|---|---|
| Section 3.03 - In order to assist KNR in the implementation of a commercial accounting system for the KNR's accounts, the Borrower shall cause the KNR to employ consultants acceptable to the Bank upon terms and conditions satisfactory to the Bank. | KNR engaged Touche, Ross and Co. (Canada), contract dated October 16, 1974. |
| Section 4.02(c) - Except as the Bank shall otherwise agree, the Borrower shall cause the KNR (i) to prepare, with the assistance of the consultants referred to in Section 3.03 of this Agreement, a time-phased program for implementing, not later than January 1, 1975, the commercial accounting system for the KNR's accounts adopted from 1971; and (ii) to promptly furnish the said program to the Bank for its comments. | Program prepared and furnished to the Bank. |

V. Fifth Project - Loan 1101-KO (April 10, 1975)

| | |
|---|---|
| Section 4.04 - The Borrower shall cause KNR within 12 months of the date of this Agreement, or such other date as the Borrower and the Bank shall agree, to implement a time-phased program for the installation of a commercial accounting and traffic costing system acceptable to the Bank. | The contract with consultants (section 3.03 above) was extended in phases until early 1977. The consultants revised the manual system prepared by the original consultants (under Cr. 25-KO) and computerized it. there have been considerable delays in installing the revised system due to KNR's lack of suitably qualified and experienced accounting and computer staff needed to work with the consultants. Work on installing the system commenced in 1977 and is expected to be completed early this year (para 2.35 of Staff Appraisal Report on Sixth Project). |

3. When the first Credit was made in 1962, the Ministry of Transportation was responsible for the operation of the railway and had four bureaus dealing almost exclusively with the matters relating to it. Since then considerable progress has been made in providing KNR with a greater degree of autonomy, both operationally and financially. Progress on commercial accounting, developed by consultants, has been slow, due to difficulties in KNR supplying sufficient qualified and experienced staff to work with the consultants and in developing and implementing a commercial accounting system in parallel with the traditional budgetary accounts required by the Government. However, as indicated above, installation should be completed by the end of this year (para. 2.35 of Staff Appraisal Report and para. 4.03 of the draft Loan Agreement sets a deadline of December 31, 1978 for such completion).

4. Because of the importance that the Government attaches to the railway, not only as an important transport mode but also for security reasons, it is understandable that it wants to keep substantial control on KNR. As shown by the very high operating performance of KNR this has not been detrimental. However, there are measures which can be taken within the Government accounting and budgetary framework, while giving KNR as much autonomy as possible. We intend to include in the proposed Loan Agreement a covenant similar to the one agreed to for the Korea Maritime and Port Authority (KMPA) in Loan 1401-KO, which would achieve this objective.

## B. KNR'S Financial Situation

1. Tariffs and Financial Performance. All the five Loan/Credit Agreements have covenants stipulating that the Borrower shall cause KNR to have its tariffs reflect costs and also that KNR shall take all measures, not limited to tariffs, to enable KNR to cover its working expenses, meet debt service requirements, maintain adequate working capital, establish reserves for contingencies, and finance a reasonable proportion of its capital.

2. The requirements, and degree of compliance, under each agreement are as follows:

I. Second Project - Credit 110-KO (December 18, 1967)

| | |
|---|---|
| Section 4.03 - The Borrower shall cause the National Railroad to establish and maintain tariffs of rates and fares which will provide revenues sufficient to meet all operating expenses, including adequate maintenance and depreciation, and to earn an adequate rate of return on the net fixed assets in use of the National Railroad. | |
| According to the Supplemental Letter entitled "Rates and Charges: Cash Position" | Actual Returns Earned: |
| (i) the adequate rates of return were to be "not less than 5% for 1969-70 and not less than 6% for 1971 and thereafter. | 1969 4.4%<br>1970 2.9%<br>1971 nil |
| (ii) tariff increases of 50% passenger fares and 30% freight rates no later than January 1, 1968. | Done, October 1, 1967. |
| (iii) and further revisions of tariffs as needed to bring rates and fares in close relation to costs of service provided. | May 20, 1969 reclassification of freight rates corresponding to 15% p.a. increase in freight revenues. December 27, 1969 35% increase in passenger fares. |
| (iv) adequate cash position to meet debt interest and amortization, working capital contingencies, a material part of the costs of capital investment. | Not achieved. |

II. Third Project - Credit 183-KO/Loan 669-KO (May 14, 1970)

| | |
|---|---|
| Section 4.15 - Revise tariffs as necessary to bring rates and fares into close relationship to the costs of services provided, no later than 12 months from the date of receipt of ongoing consultant's study (i.e. about July/August 1971). | Recommendations of study not yet implemented. Apart from some action in revising the freight tariff structure (i.e. increasing from 3 classes to 5 classes in May 1969 and reducing to 4 classes in January, 1977) the Government has almost always adjusted tariffs across the board. For the proposed Sixth Project we are seeking agreement that tariffs will, in future, be raised selectively, with due regard to costs. |

| | |
|---|---|
| Section 4.16 - General requirements similar to Supplemental Letter of December 18, 1967 to Second Project. Specifically, KNR was to earn annual rates of return of 7% commencing 1971. | Actual returns earned:<br>1971 - nil<br>1972 - 0.9%<br>1973 - 1.1% |

III. Fourth Project - Loan 863-KO (November 22, 1972)

| | |
|---|---|
| Section 4.05 - The Borrower shall enable KNR to charge fares on the Seoul Metropolitan Electrified Suburban Services (SMESRS) to cover, at least, the variable cost of operating the services. The Borrower shall promptly reimburse the KNR for any uncovered portion of the full cost of operating the SMESRS. | KNR's costing indicates that full costs of the SMESRS are being covered by revenues. |
| Section 4.07 - Required KNR to earn return of not less than 2% (1975), 3% (1976) and 5% (by 1978). | KNR actually earned:<br>1975 - 0-1%<br>1976 - nil |

IV. Supplemental Letter of November 22, 1972

| | |
|---|---|
| The Government undertook: | Regarding: |
| (i) To increase freight tariffs by at least 20% as soon as possible, but in any case by January 1, 1974; | (i) Freight rates were raised 10% in January 1974, and a further 5% in February 1974; passenger fares were raised by 25% in February 1974, and KNR was allowed to retain the 10% transportation tax on passenger fares, in force since 1963, and previously paid over to the Government. |
| (ii) To increase passenger and freight tariffs, but no later than January 1, 1975 by such amounts as would secure total additional revenues equal to the total additional revenues which would have been earned had the passenger tariffs only been raised by 20%, by this date. | |
| (iii) To increase freight tariffs by an average of at least 20% by January 1, 1976. | Regarding (ii) Freight rates were raised selectively in December 1974, by amounts of between 35% and 40%. Passenger fares were not increased. |
| The above increases were to be made on the assumptions that: | Regarding (iii), freight rates were raised 10% (excluding coal) in July 1975 and by 35% in January 1976; passenger fares were raised by 20% in July 1975. |

| | |
|---|---|
| (a) the wholesale price index in Korea would rise at no more than 3% p.a., and | Regarding (a), the wholesale price index in Korea rose by 7% in 1973, 42% in 1974, 26% in 1975 and 11% in 1976. |
| (b) KNR's staff wage levels would be subject to general wage revisions of no more than 10% each year and only in the years 1974 and 1976. | Regarding (b) KNR's staff wages were raised by over 20% in 1974; in early 1976, although the increase in wages granted nationally was 45%, due to KNR's salary structure the effect was to raise railway wage costs by about 70%. |
| In addition, should the increases assumed in (a) and (b) actually be higher, or should any other events arise which would make it unlikely that the above mentioned tariff increases would be sufficient to achieve the required rates of return, the Government undertook to review, in October of each year, KNR's financial situation, and would consult with the Bank on measures, such as tariff increases or cost reduction, needed to achieve the required results. | The Government paid to KNR cash subsidies of W 1.5 billion in 1973, W 5.7 billion in 1974, W 14.4 billion in 1975 and W 13.7 billion in 1976 described as "partial compensation for revenues foregone due to not implementing a general rate increase in 1973." |

V. Fifth Project - Loan 1101-KO (April 10, 1975)

| | |
|---|---|
| Section 4.05 - The Borrower shall cause KNR, by December 1976 or such other date as the Borrower and the Bank shall agree, to carry out a revaluation of KNR's fixed assets in accordance with appropriate and consistently maintained methods of valuation acceptable to the Bank. | Revaluation was carried out and the results reflected in KNR's balance sheet of December 31, 1976. |
| Section 4.06 - The Borrower shall cause KNR to take all necessary measures, including but not limited to adjustments of the tariff structure and rates of KNR, as shall be required to enable KNR (a) to earn an annual rate of return of not less than 2% commencing fiscal year 1976, 3-1/2% by 1977 and 5-1/2% thereafter; and (b) attain a ratio of current assets to current liabilities of not less than 1.2 by fiscal year 1979. (The rate of return requirement was modified by a Supplemental Letter of April 10, 1975 which set 1980 as the deadline for achieving the agreed financial targets). | In 1975 KNR earned a return of 0.1%, but no return was earned in 1976. Although revenues were higher than forecast, expenses were much higher, particularly staff costs, due to mandatory wage awards. Freight rate increases of 10% (April 1975) and 35% (January 1976) and a passenger fare increase of 20% (April 1976) were inadequate to compensate for inflation and the wage awards. |

VI. Supplemental Letter of April 10, 1975 - "KNR's Financial Situation"

| | |
|---|---|
| (a) The Government intends, until such time as a financial plan acceptable to the Bank can be formulated and implemented, to provide the KNR with the funds necessary to meet the service of all its foreign and local borrowings. | (a) Funds were provided in 1975, and 1976 in the form of additional borrowings from the Korean Development Bank. |
| (b) The Government shall formulate such a (financial recovery) plan and discuss it with the Bank within eighteen months of the signature of the Loan Agreement pertaining to the above-mentioned Project so that KNR could attain the agreed financial targets set out in Section 4.06 of said Loan Agreement and the objectives set forth in this letter no later than its fiscal year, 1980. | (b) In a letter dated December 7, 1977, the Government spelled out its intentions regarding tariff increases (see para. 4, page 8). |

3. Although in the late 1960s KNR was not able to earn the full required rates of return, it did earn positive returns until 1971. In that year competition from improved highways, and in particular, the opening of the Seoul-Busan expressway, eroded KNR's profitable passenger traffic. The financial performance deteriorated even further in 1973-75 following the sharp inflation caused by the oil crisis. The Korean Government, as most other governments have done, has argued for keeping public sector tariffs low so as not to further contribute to inflation. As a result freight rates were not increased between March 1972 and Janury 1974, while passenger fares were not increased between January 1970 and January 1974. In order to alleviate the effect on KNR's finances the Government has provided annual subsidies of W 0.7 billion in 1972, W 1.5 billion in 1973, W 5.7 billion in 1974, W 14.4 billion in 1975 and W 13.7 billion in 1976.

4. With inflation somewhat abated in 1977, the Government is now prepared to grant reasonable tariff increases as given in the letter of the Deputy Prime Minister dated December 7, 1977, the receipt of which was made a condition of submitting loan documents to the Loan Committee. Assuming that the rate of inflation will not exceed 10%, the proposed tariff increases will enable the achievement of the financial targets by the date specified in the Supplemental Letter to the Loan Agreement for the Fifth Railway Project. We will seek assurances that the proposed tariff increases will be adjusted upwards if inflation is greater than anticipated.

## C. Operational and Technical Matters

1. Most agreements specify technical and operational studies to be conducted generally in association with proposed developments and investments. All required studies have been conducted and the results communicated and discussed with the Bank. In general recommendations have been implemented. The continuously improving performance level of KNR shows that the dialogue with the Bank on operational and technical matters has generally been successful. Further studies are included in the Sixth Project to continue improvements. A list of the subjects studied under the various agreements is given below:

Second Project - Credit 110-KO (December 18, 1967)

2. Rolling stock maintenance and design, marshalling yard requirements, coal transport and distribution in Seoul area, uneconomic lines (Supplemental Letter on consultants). All studies were done and agreements to implement recommendations were reached during negotiations of the Third and Fourth projects with the major ones being the object of covenants in those agreements (see paras. 3 and 4 below).

Third Project - Credit 183-KO/Loan 669-KO (May 14, 1970)

3. Maintenance of diesel locos and rail cars, modernization and expansion of telecommunication network, evaluation of bids for diesel locos, workshop construction at Daejon (Section 4.10 to 4.13). All studies have been conducted. Availability of diesel locos and rail cars has been constantly increasing from 83% in 1971 to 87% in 1976 for diesel locos and from 67% to 80% for diesel rail cars. Detailed schemes for improving telecommunications were recommended by consultants and financed and implemented under the Project. Consultants recommended the construction of a new workshop at Daejon, construction has started for the freight car workshop and will start under the Sixth Project for the passenger car workshop. Recommendations regarding coal transport were partially implemented (Section 4.14). A study of bulk commodities including coal is included in the Sixth Project with a view to preparing a project for Bank financing to further improve distribution of bulk commodities, mainly coal and cement.

Fourth Project - Loan 863-KO (November 22, 1972)

4. No new study was specified under this agreement but covenants covered the completion of construction and improvement of marshalling yards studied under the Second Project (Section 3.07) and further rationalization of workshops in connection with the electrification of the industrial line (Section 3.08). Marshalling yards and workshops continue to be improved and expanded in line with traffic growth.

Fifth Project - Loan 1101-KO (April 10, 1975)

5. No new study was specified under this agreement but covenants covered further improvements to be made in workshops with a view to further increasing availability of motive power and rolling stock (Section 3.07). An advisor was appointed and commenced work late in 1976. Since the availability and utilization of motive power and rolling stock in Korea is generally high compared to most other railways, improvements, while always possible, require constant efforts. Results are gradual and long term.

D. Transport Investment and Coordination

1. In 1965, the Bank made a technical assistance grant for a comprehensive survey of all modes of transport in Korea. The study drew attention to the need to develop roads in the country as well as provide for transport coordination. In 1968 a Technical Assistance and Engineering Credit (S4-KO) was made to study the highway sector as well as review responsibilities of ministries concerned with transportation, with a view to establishing an organization for the coordination of transport.

Third Project - Credit 183-KO/Loan 669-KO (May 1970)

2. This Credit refers to the study conducted under S4-KO mentioned above as follows:

| | |
|---|---|
| Section 4.19 - Upon completion of the study by consultants of transport coordination and highway organization currently in progress, the Borrower shall promptly consult with the Association with a view to agreeing, not later than December 31, 1970, on (i) measures necessary to achieve adequate coordination in the field of transportation, particularly with respect to the establishment of a body satisfactory to the Borrower and the Association for overall planning of the transport sector; and (ii) the timing for the implementation of said measures. | In early 1970 the Government established a three-tiered organization responsible for transport planning and coordination:<br><br>The Transport Coordination Ministers Conference (TCMC);<br><br>The Transport Coordination Working Group (TCWG); and,<br><br>The Transport Planning Office (TPO) in the Ministry of Transport (MOT).<br>It was intended that TPO would be responsible for undertaking economic analysis and rendering professional advice to TCMC on investment planning and important policy measures including licensing, pricing and taxation within the subsectors of transport. TCMC met rarely and the TPO with limited staff and its location in one of the concerned Ministries could hardly be expected to perform its envisaged role of investment coordination. |

Fourth Project - Loan 863-KO (November 22, 1972)

| | |
|---|---|
| Section 4.06 - With a view to improving transport planning and coordination, the Borrower shall (i) take all measures necessary on its part to enable the TPO to collect and prepare reliable data relating to the cost and operations of all modes of transport; (ii) review the function and work program of the TPO; (iii) cause the TPO to furnish to the Bank quarterly reports relating to its work; (iv) cause all relevant agencies of the Borrower, including the Ministry of Construction of the Borrower, to ensure | Slow progress was made in strengthening TPO. In 1973 the first two staff members were sent overseas for training as transport economists. |

that all major investment proposals relating to the transport sector are furnished to the TPO for the purposes of appraisal and ensuring coordination in respect thereof; and (v) strengthen economic expertise in the TPO by making appointments to, or training the staff of, TPO.

4. In 1973, EPB was reviewing the functions and work program of TPO with a view to implementing this agreement (Appraisal report of the Second Highway Project). This matter was discussed during the negotiations of that project (956-KO, January 25, 1974) and the Government promised to submit a status report on TPO with a view to discussing appropriate action by mid-1974. Little progress was made as the Government could not reach a firm conclusion about TPO's work program.

Fifth Project - Loan 1101-KO (April 10, 1975)

Section 3.13 - Within 12 months of the date of submission of the time-phased program referred to in Section 6.01 of this Agreement or other date as the Borrower and the Bank shall agree, the Borrower shall take measures, including the issuance of appropriate decrees acceptable to the Bank, to ensure the effective formulation and review of the Borrower's policies and investment proposals made by all its agencies and ministries related to the transport sector, including, inter alia, highways, railways, ports, inland water transport, shipping and aviation.

Presidential decrees were issued in July and August 1975 establishing a Transport Coordination Office (TCO) in the Ministry of Transportation, and an inter-ministerial Transport Coordination Committee (TCC), TCO is headed by a Director General, a high ranking civil servant reporting directly to the Vice Minister of Transport; he also chairs the TCC. The functions of TCO and TCC are given in Annexes 4 and 5 of the Korea Transport Sector Mission full report of February 11, 1976. For the preparation of the Fourth Plan an inter-ministerial working group on transportation prepared detailed transport demand forecasts providing a useful basis for investment planning.

6. While the charter of the TCC includes intermodal coordination of transport sector investments, the TCC has in fact not exercised this function. The Economic Planning Board (EPB), which exercises budgetary control and plays a senior role with regard to all other ministries, has the dominant role in decision on investment projects. EPB intends to make much more intensive reviews of investment projects and has established a separate Bureau of Project Evaluation to this end. Sector studies covering major aspects of transport coordination have been identified by the sector mission and are included in the Sixth Project. They will be carried out under the supervision of EPB.

7. This approach appears much more satisfactory and workable than the one where investment coordination was to come under one of the ministries, namely MOT. The role of the TCO should remain one of collecting basic data in the sector and assisting in the formulation and review of transport policies, especially those related to pricing and regulation since MOT is the Ministry responsible for licensing and rates and fares setting.

KOREA

SIXTH RAILWAY PROJECT

Traffic Statistics 1966 to 1976 Actual and 1981 Forecast

Freight

| | Actual | | | | | | | | Forecast | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1966 | % | 1971 | % | AAGR/a 66-71 % p.a. | 1976 | % | AAGR 71-76 % p.a. | 1981 | % | AAGR 76-81 % p.a. |
| Tons (million) | | | | | | | | | | | |
| Railway | 24 | 41 | 32 | 22 | 5.9 | 44 | 20 | 6.6 | 62 | 18 | 7.1 |
| Highway | 33 | 56 | 102 | 70 | 25.0 | 164 | 74 | 10.0 | 263 | 75 | 10.0 |
| Public | (25) | | (74) | | (24.0) | (94) | | (4.9) | (151) | | (10.0) |
| Private | (8) | | (28) | | (29.0) | (70) | | (20.0) | (112)/b | | (10.0) |
| Coastal | 2 | 3 | 11 | 8 | 40.0 | 14 | 6 | 4.9 | 25 | 7 | 12.3 |
| Total | 59 | 100 | 145 | 100 | | 222 | 100 | | 350 | 100 | |
| Ton-km (billion) | | | | | | | | | | | |
| Railway | 5.4 | 78 | 7.8 | 47 | 7.6 | 9.7 | 46 | 4.5 | 13.9 | 41 | 7.0 |
| Highway | .8 | 12 | 4.0 | 24 | 38.0 | 5.7 | 27 | 7.3 | 9.8 | 30 | 11.5 |
| Public | (.6) | | (3.3) | | | (4.4) | | (5.9) | (7.6) | | (11.5) |
| Private | (.2) | | (0.7) | | | (1.3) | | (13.2) | (2.2)/b | | (11.5) |
| Coastal | 0.7 | 10 | 4.7 | 29 | 46.0 | 5.5 | 27 | 3.2 | 9.4 | 29 | 11.4 |
| Total | 6.9 | 100 | 16.5 | 100 | | 20.9 | 100 | | 33.1 | 100 | |

/a AAGR: Average Annual Growth Rate.
/b Estimated using the same growth rate as for public transport since no forecasts are available.

Source: Ministry of Transport, Statistics Yearbook of Transportation 1976 (M.O.T.), FFYP 1977-81, and mission's estimates.

Table 1.1

KOREA

SIXTH RAILWAY PROJECT

Traffic Statistics 1966 to 1976 Actual and 1981 Forecast

Passengers

| | Actual | | | | | | | Forecast | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1966 | % | 1971 | % | AAGR/a 66-71 % p.a. | 1976 | % | AAGR 71-76 % p.a. | 1981 | % | AAGR 76-81 % p.a. |
| Passengers (million) | | | | | | | | | | | |
| Railway | 138 | 8 | 128 | 4 | | 288 | 5 | not signif. | 433 | 5 | not signif. |
| Intercity | (138) | - | (128) | - | -1.5 | (149) | - | 3.1 | (178) | (2) | (3.6) |
| SMESRS /b | - | - | - | - | | (134) | - | - | (265) | (3) | (14.6) |
| Highway | 1,512 | 91 | 3,024 | 96 | 14.9 | 5,051 | 95 | 10.8 | 7,769 | 95 | 9.0 |
| Intercity | (272) | (16) | (333) | (11) | (4.1) | (652) | (12) | (14.4) | (792) | (10) | (4.0) |
| Urban | (1,240) | (75) | (2,691) | (85) | (16.8) | (4,399) | (83) | (10.3) | (6,977) | (85) | (9.7) |
| Coastal | 6 | 1 | 6 | <1 | - | 6 | <1 | - | 7 | <1 | - |
| Aviation | - | - | 1 | <1 | - | 1 | <1 | - | 2 | <1 | - |
| Total | 1,656 | 100 | 3,159 | 100 | | 5,341 | 100 | | 8,221 | 100 | |
| Passenger-km (billion) | | | | | | | | | | | |
| Railway | 8.7 | 43 | 8.8 | 27 | 0.0 | 14.7 | 25 | not signif. | 20.4 | 22 | not signif. |
| Intercity | (8.7) | - | (8.8) | - | - | (12.4) | (21) | 7.1 | (16.5) | (18) | (5.9) |
| SMERS /b | - | - | - | - | - | (2.3) | (4) | - | (3.9) | (4) | (11.1) |
| Highway | 11.5 | 56 | 22.9 | 71 | 14.8 | 43.4 | 74 | 13.6 | 71.6 | 77 | 10.6 |
| Intercity | N.A. | | (11.6) | (36) | N.A. | (25.0) | (43) | (16.6) | (42.4) | (46) | (11.1) |
| Urban | N.A. | | (11.3) | (35) | N.A. | (18.4) | (31) | (10.2) | (29.2) | (31) | (9.7) |
| Coastal | 0.2 | 1 | 0.3 | 1 | - | 0.2 | <1 | - | 0.4 | <1 | - |
| Aviation | 0.1 | - | 0.3 | 1 | | 0.3 | <1 | - | 0.6 | <1 | - |
| Total | 20.5 | 100 | 32.3 | 100 | | 58.6 | 100 | | 93.0 | 100 | |

/a AAGR: Average Annual Growth Rate.
/b SMESRS includes Traffic on KNR Seoul Suburban lines as well as Seoul City Subway.

Source: Ministry of Transport, Statistics Yearbook of Transportation 1976 (M.O.T.), and mission's estimates. The 1981 figures are those included in the Fourth Five-Year Plan 1977-81 except for railway where the revised KNR/mission estimates are shown. FFYP figures for railway were 458 million passengers and 19 billion pass-km.

Table 1.2

KOREA

SIXTH RAILWAY PROJECT

Total Transport Investment - Third Plan (1972-76) and Fourth Plan (1977-81)
(Billion Won)

| Modes | | 1972-76 /a Actual | | 1977-81 /b Planned | |
|---|---|---|---|---|---|
| Highways | (Public) | (237) | 833 | (458) | 1,226 |
| | (Private) | (596) | | (768) | |
| Railways | | | 318 | | 402 |
| Ports and Marine | (Public) | (130) | | (251) | |
| | (Private) | (412) | 522 | (745) | 996 |
| Air Transport | | | 122 | | 59 |
| Seoul Subway | | | 57 | | 101 |
| Others | | | 5 | | - |
| Total Transport Investment | | | 1,857 | | 2,784 |
| Total Capital Expenditure | | | 11,996 | | 19,028 |
| Transportation as % of Total | | | 15.7% | | 14.6% |

/a and /b Constant 1975 prices.

Source: EPB

KOREA

SIXTH RAILWAY PROJECT

KNR Track and Infrastructure - Summary by End 1976
(Standard gauge lines)

| Line | Route length (km) | Maximum gradient (%) | Minimum curve radius (m) | Total curve length (km) | Maximum axle load (tons) | Maximum speed (km/hr) | Permanent speed restrictions (km) | Sleeper type | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Wood (%) | Concrete (%) | |
| Gyeong Bu | 445 | 1.00 | 400 | 330 | 24.5 | 110 | 443 | 64 | 36 | Double track |
| Jung Ang | 380 | 2.30 | 300 | 162 | 24.5 | 80 | 328 | 76 | 24 | Double track 11 km |
| Gyeong In | 25 | 1.00 | 300 | 22 | 24.5 | 80 | 27 | 68 | 32 | Double track |
| Jang Hang | 144 | 1.53 | 300 | 45 | 22.0 | 70 | 64 | 100 | 0 | |
| Chung Bug | 122 | 1.67 | 300 | 56 | 24.5 | 70 | 88 | 100 | 0 | |
| Gyeong Bug | 110 | 2.50 | 250 | 36 | 24.5 | 70 | 65 | 96 | 4 | |
| Dae Gu | 35 | 1.25 | 300 | 12 | 24.5 | 80 | 22 | 56 | 44 | |
| Gyeong Eui | 46 | 1.00 | 300 | 12 | 24.5 | 90 | 25 | 96 | 4 | |
| Gyeong Weon | 89 | 1.33 | 300 | 24 | 24.5 | 80 | 56 | 87 | 13 | |
| Gyeong Chun | 87 | 2.45 | 250 | 41 | 24.5 | 70 | 71 | 100 | 0 | |
| Gyeong Jeon | 320 | 2.50 | 250 | 133 | 22.0 | 70 | 257 | 99 | 1 | |
| Ho Nam | 260 | 1.33 | 300 | 92 | 24.5 | 90 | 152 | 60 | 40 | Double track 78 km |
| Jeon Ra | 198 | 2.50 | 250 | 87 | 24.5 | 80 | 142 | 74 | 26 | |
| Donghae Nambu | 146 | 1.40 | 300 | 55 | 24.5 | 80 | 85 | 80 | 20 | |
| Tae Baeg | 91 | 3.03 | 300 | 51 | 24.5 | 70 | 95 | 98 | 2 | |
| Yeong Dong | 199 | 3.00 | 250 | 120 | 24.5 | 70 | 196 | 96 | 4 | |
| Other lines | 400 | | | 176 | | | 274 | 96 | 4 | |
| Total | 3,097 | | | 1,454 | | | 2,390 | 81 | 19 | |

Source: KNR

Table 2.1

KOREA

SIXTH RAILWAY PROJECT

Rails in KNR Standard Gauge Main Line Tracks at End of 1976
(Quantities in track km)

| Line | Rail weight (kg/m) and age (years) | | | | | | | | | | | | | | | Grand Total | Rail length | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 kg/m | | | | | 37 kg/m | | | | | Less than 37 kg/m | | | | | | Long Welded | 20-25 m | Less than 20 m | Grand total |
| | <10 | 11-20 | 21-30 | >30 | Total | <10 | 11-20 | 21-30 | >30 | Total | <10 | 11-20 | 21-30 | >30 | Total | | | | | |
| Gyeong Bu | 734 | 162 | 59 | 46 | 1,001 | - | - | - | 4 | 4 | - | - | - | - | - | 1,005 | 879 | 874 | 17 | 1,005 |
| Jung Ang | 313 | 42 | 24 | 29 | 408 | - | - | - | 55 | 55 | - | - | - | - | - | 463 | 13 | 370 | 80 | 463 |
| Gyeong In | 60 | 22 | - | - | 82 | - | - | - | 1 | 1 | - | - | - | - | - | 83 | 6 | 70 | 7 | 83 |
| Jang Hang | 146 | - | 8 | - | 154 | - | - | - | - | - | - | - | - | - | - | 154 | - | 131 | 23 | 154 |
| Chung Bug | 82 | 20 | 16 | - | 118 | - | 12 | 11 | - | 23 | - | - | - | - | - | 141 | 4 | 113 | 24 | 141 |
| Gyeong Bug | 3 | 86 | - | - | 89 | - | 35 | 2 | - | 37 | - | - | - | - | - | 126 | 2 | 95 | 29 | 126 |
| Dae Gu | 15 | - | 2 | 23 | 40 | - | - | - | - | - | - | - | - | - | - | 40 | - | 32 | 8 | 40 |
| Gyeong Eui | 14 | 19 | 30 | - | 63 | - | - | - | - | - | - | - | - | - | - | 63 | 10 | 45 | 8 | 63 |
| Gyeong Weon | 41 | 18 | 1 | - | 60 | - | - | 13 | 57 | 70 | - | - | - | - | - | 130 | 9 | 97 | 24 | 130 |
| Gyeong Chun | 6 | 4 | 42 | 19 | 71 | - | - | - | 22 | 22 | - | - | - | - | - | 93 | - | 60 | 33 | 93 |
| Gyeong Jeon | 107 | 55 | - | - | 162 | - | 193 | - | - | 193 | - | - | - | - | - | 355 | 6 | 248 | 101 | 355 |
| Ho Nam | 283 | 20 | 25 | 11 | 339 | - | - | - | 6 | 6 | - | - | - | - | - | 345 | - | 265 | 80 | 348 |
| Jeon Ra | 146 | 20 | - | - | 166 | - | 10 | 38 | - | 48 | - | - | - | - | - | 214 | 15 | 161 | 38 | 214 |
| Donghae Nambu | 86 | 11 | 11 | 21 | 129 | - | 14 | 19 | - | 33 | - | - | - | - | - | 162 | 12 | 121 | 29 | 162 |
| Tae Baeg | 103 | 13 | - | - | 116 | - | - | - | - | - | - | - | - | - | - | 116 | - | 90 | 26 | 116 |
| Yeong Dong | 116 | 36 | 14 | - | 166 | - | 42 | 15 | - | 57 | - | - | - | - | - | 223 | - | 174 | 49 | 223 |
| Other lines | 20 | 17 | 25 | 19 | 81 | 21 | 28 | 48 | 91 | 188 | - | - | 27 | 101 | 128 | 397 | - | 218 | 179 | 397 |
| Total | 2,375 | 545 | 257 | 168 | 3,245 | 21 | 334 | 146 | 236 | 737 | - | - | 27 | 101 | 128 | 4,110 | 191 | 3,164 | 755 | 4,110 |

Source: KNR

Table 2.2

KOREA

SIXTH RAILWAY PROJECT

Inventory of Motive Power and Rolling Stock
(December 31, 1976)

| | Total | | | Out of service | | Age | | | | Condition | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In fleet Number | In service Number | % | Under repair Number | Awaiting repair Number | <10 yrs Number | 11-20 yrs Number | 21-30 yrs Number | >30 yrs Number | Good Number | Fair Number | Poor Number |
| 1. Steam Locomotives | 68 | 20 | 29.4 | - | 48 | - | - | 25 | 43 | - | - | 68 |
| 2. Diesel Locomotives | | | | | | | | | | | | |
| Shunter, series 2000 (800 HP) | 13 | 13 | 100.0 | - | - | - | 9 | 4 | - | - | - | 13 |
| Shunter, series 2100 (1,000 HP) | 28 | 28 | 100.0 | - | - | 28 | - | - | - | 28 | - | - |
| Shunters, total | 41 | 41 | 100.0 | - | - | 28 | 9 | 4 | - | 28 | - | 13 |
| Mainline locomotives, series 3000 (875 HP) | 52 | 47 | 90.4 | 5 | - | - | 52 | - | - | - | 30 | 22 |
| Mainline locomotives, series 3100 (950 HP) | 32 | 32 | 66.7 | - | 16 | 17 | 31 | - | - | - | 17 | 31 |
| Mainline locomotives, series 3200 (875 HP) | 16 | | | | | | | | | | | |
| Mainline locomotives, series 4000 (1,300 HP) | 15 | 13 | 86.7 | 2 | - | - | 15 | - | - | - | 15 | - |
| Mainline locomotives, series 4100 (1,300 HP) | 10 | 10 | 100.0 | - | - | - | 10 | - | - | - | 10 | - |
| Mainline locomotives, series 4200 (1,300 HP) | 22 | 22 | 100.0 | - | - | 22 | - | - | - | - | 22 | - |
| Mainline locomotives, series 5000 (1,750 HP) | 29 | 26 | 89.7 | 3 | - | - | 29 | - | - | - | 15 | 14 |
| Mainline locomotives, series 6000 (1,800 HP) | 14 | 13 | 92.8 | 1 | - | - | 14 | - | - | - | - | 14 |
| Mainline locomotives, series 6100 (1,800 HP) | 6 | 6 | 100.0 | - | - | - | 6 | - | - | - | 6 | - |
| Mainline locomotives, series 6200 (1,800 HP) | 16 | 14 | 87.5 | 2 | - | 16 | - | - | - | - | 16 | - |
| Mainline locomotives, series 6300 (2,000 HP) | 23 | 20 | 86.9 | 3 | - | 23 | - | - | - | - | 23 | - |
| Mainline locomotives, series 7000 (3,000 HP) | 10 | 10 | 100.0 | - | - | 10 | - | - | - | - | 10 | - |
| Mainline locomotives, series 7100 (3,000 HP) | 10 | 10 | 100.0 | - | - | 10 | - | - | - | 10 | - | - |
| Mainline locomotives, series 7500 (3,000 HP) | 90 | 87 | 96.7 | 3 | - | 90 | - | - | - | 90 | - | - |
| Mainline locomotives, total | 345 | 310 | 89.8 | 19 | 16 | 188 | 177 | - | - | 100 | 164 | 81 |
| Grand total | 386 | 351 | 90.9 | 19 | 16 | 216 | 186 | 4 | - | 128 | 164 | 94 |
| 3. Electric Locomotives | | | | | | | | | | | | |
| a. Mainline locomotives | 69 | 59 | 85.5 | 6 | 4 | 69 | - | - | - | 69 | - | - |
| b. Shunters | - | - | - | - | - | - | - | - | - | - | - | - |
| 4. Diesel Railcars (Hauling units) | 120 | 99 | 82.5 | 11 | 10 | 4 | 116 | - | - | - | 4 | 116 |
| 5. Electric Railcars (Hauling units) | 128 | 114 | 89.1 | 14 | - | 128 | - | - | - | 128 | - | - |
| 6. Heating Cars | 140 | 114 | 81.4 | 20 | 6 | 103 | 37 | - | - | - | 103 | 37 |
| 7. Passenger Cars | | | | | | | | | | | | |
| a. Airconditioned coaches | 71 | 65 | 91.5 | 4 | 2 | 71 | - | - | - | 71 | - | - |
| b. Other coaches | 1,388 | 1,297 | 93.4 | 67 | 24 | 707 | 538 | 50 | 93 | 707 | 588 | 143 |
| c. Sleeping cars | 29 | 27 | 93.1 | 2 | - | 22 | - | - | 7 | 22 | - | 7 |
| d. Restaurant cars | 21 | 20 | 95.2 | 1 | - | 18 | 3 | - | - | 18 | 3 | - |
| e. Baggage cars | 114 | 107 | 93.9 | 4 | 3 | 35 | 26 | 12 | 41 | 35 | 26 | 53 |
| f. Railcar trailers | 143 | 138 | 96.5 | 5 | - | 32 | 111 | - | - | 32 | 111 | - |
| g. Other | 40 | 38 | 95.0 | 2 | - | 17 | - | 4 | 19 | 17 | 4 | 23 |
| Total | 1,806 | 1,692 | 93.7 | 85 | 29 | 902 | 678 | 66 | 160 | 902 | 678 | 226 |
| 8. Freight Cars | | | | | | | | | | | | |
| a. Box cars | 5,169 | 4,680 | 90.5 | 233 | 256 | 2,967 | 32 | 1,665 | 505 | 2,967 | 1,445 | 757 |
| b. Gondolas | 6,655 | 6,175 | 92.7 | 366 | 114 | 4,635 | 982 | 540 | 498 | 4,635 | 1,409 | 611 |
| c. Tank cars | 2,427 | 2,280 | 93.9 | 72 | 75 | 1,662 | 161 | 440 | 164 | 1,662 | 508 | 257 |
| d. Others | 1,804 | 1,679 | 93.8 | 81 | 44 | 77 | 1,049 | 322 | 356 | 77 | 1,381 | 346 |
| Total | 16,055 | 14,814 | 92.3 | 752 | 489 | 9,341 | 2,224 | 2,967 | 1,523 | 9,341 | 4,743 | 1,971 |
| 9. Privately Owned Freight Wagons | | | | | | | | | | | | |
| a. Box cars | (125) | | | - | - | (125) | - | - | - | (125) | - | - |
| b. Gondolas | (224) | | | - | - | (224) | - | - | - | (224) | - | - |
| c. Tank cars | (1,071) | | | - | - | (844) | (54) | (173) | - | (844) | (227) | - |
| d. Others | (35) | | | | | | | | | | | |
| Total | (1,455) | | | - | - | (32) (1,225) | (54) | (3) (176) | - | (32) (1,225) | (3) (230) | - |

Source: KNR

Table 2.4

KOREA

SIXTH RAILWAY PROJECT

Carrying Capacity of Rolling Stock
(As of December 31, 1976)

| | | Number | | Total carrying capacity /a | |
|---|---|---|---|---|---|
| 1. | Passenger Cars | | | | |
| | (a) Airconditioned sitting cars | 71 | | 3,396 | |
| | (b) Other sitting cars | 1,388 | | 97,932 | |
| | (c) Sleeping cars | 29 | | 812 | |
| | Total | 1,488 | | 112,140 | |
| 2. | Freight Cars | | | | |
| | (a) Box cars - up to 30 tons | 550 | | 15,405 | |
| | 31-40 tons | 2,834 | | 113,360 | |
| | over 40 tons | 1,785 | 5,160 | 89,250 | 218,015 |
| | (b) Gondolas - up to 30 tons | 513 | | 15,030 | |
| | 31-40 tons | 2,291 | | 91,640 | |
| | 41-50 tons | 3,851 | 6,655 | 192,550 | 299,220 |
| | (c) Tank cars- up to 30 tons | 391 | | 10,783 | |
| | 31-40 tons | 1,044 | | 40,035 | |
| | over 40 tons | 992 | 2,427 | 49,565 | 100,383 |
| | (d) Other cars | 1,804 | 1,804 | 76,358 | 76,358 |
| | Total | | 16,055 | | 693,976 |

/a For passenger cars seats, for freight wagons tons.

Source: KNR.

KOREA

SIXTH RAILWAY PROJECT

KNR Freight Traffic: 1966-76 Actual and 1977-81 Forecast
(Million tons)

| Years | Major Commodities | | | | | | | Others | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Coal | Cement | Ore | Oil | Fertilizer | Grain | Subtotal | General cargo | Container | Military | KNR | |
| Actual | | | | | | | | | | | | |
| 1966 | 10.5 | 1.7 | 1.1 | 0.9 | 1.2 | 1.2 | 16.6 | 4.4 | | 2.1 | 0.9 | 24.0 |
| Second FYP | | | | | | | | | | | | |
| 1967 | 11.2 | 2.2 | 1.4 | 1.4 | 1.2 | 1.3 | 18.7 | 5.6 | | 2.3 | 0.8 | 27.4 |
| 1968 | 9.7 | 3.2 | 1.7 | 1.7 | 1.5 | 1.6 | 19.4 | 5.9 | | 2.8 | 1.0 | 29.1 |
| 1969 | 10.4 | 4.4 | 1.7 | 2.1 | 1.2 | 1.4 | 21.2 | 5.6 | | 2.7 | 1.2 | 30.7 |
| 1970 | 12.1 | 4.9 | 1.8 | 2.4 | 1.1 | 1.3 | 23.6 | 5.0 | | 2.1 | 1.0 | 31.7 |
| 1971 | 12.2 | 5.8 | 1.6 | 2.5 | 1.1 | 1.4 | 24.6 | 4.6 | | 1.9 | 0.9 | 32.0 |
| Third FYP | | | | | | | | | | | | |
| 1972 | 11.3 | 6.0 | 1.5 | 2.2 | 1.3 | 1.6 | 23.9 | 4.6 | - | 2.4 | 0.7 | 31.6 |
| 1973 | 13.6 | 7.5 | 2.3 | 2.7 | 1.5 | 1.6 | 29.2 | 5.5 | 0.2 | 1.7 | 1.0 | 37.6 |
| 1974 | 15.1 | 7.8 | 2.9 | 2.7 | 1.9 | 1.3 | 31.7 | 5.1 | 0.2 | 1.3 | 1.1 | 39.4 |
| 1975 | 16.7 | 9.0 | 3.0 | 3.1 | 2.2 | 1.0 | 35.0 | 5.0 | 0.2 | 1.4 | 1.1 | 42.7 |
| 1976 | 16.1 | 10.2 | 3.4 | 3.1 | 1.8 | 1.3 | 35.9 | 4.8 | 0.3 | 1.5 | 1.3 | 43.8 |
| Forecast | | | | | | | | | | | | |
| Fourth FYP | | | | | | | | | | | | |
| 1977 | 17.1 | 11.0 | 3.6 | 3.4 | 1.9 | 1.5 | 38.6 | 5.6 | 0.4 | 1.5 | 1.3 | 47.3 |
| 1978 | 18.7 | 11.8 | 4.0 | 3.7 | 2.2 | 1.6 | 42.0 | 5.9 | 0.6 | 1.5 | 1.3 | 51.3 |
| 1979 | 20.2 | 12.2 | 4.8 | 4.0 | 2.4 | 1.7 | 45.3 | 6.2 | 0.8 | 1.5 | 1.3 | 55.1 |
| 1980 | 21.5 | 12.5 | 5.2 | 4.0 | 2.6 | 1.7 | 47.5 | 6.5 | 1.1 | 1.5 | 1.3 | 57.9 |
| 1981 | 23.0 | 13.0 | 5.8 | 4.5 | 2.7 | 1.8 | 50.8 | 6.8 | 1.2 | 1.5 | 1.3 | 61.6 |

Source: KNR and mission.

Table 2.5

KOREA

SIXTH RAILWAY PROJECT

KNR Freight Traffic: 1966-76 Actual and 1977-81 Forecast
(Average distance in km)

| Years | Major Commodities | | | | | | Others | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Coal | Cement | Ore | Oil | Fertilizer | Grain | General cargo | Container | Military | KNR | |
| Actual | | | | | | | | | | | |
| 1966 | 108 | 280 | 244 | 351 | 155 | 265 | 270 | | 200 | 104 | |
| Second FYP | | | | | | | | | | | |
| 1967 | 206 | 257 | 239 | 302 | 168 | 260 | 263 | | 197 | 104 | |
| 1968 | 219 | 264 | 216 | 346 | 208 | 254 | 267 | | 196 | 97 | |
| 1969 | 321 | 207 | 236 | 297 | 275 | 274 | 286 | | 205 | 104 | |
| 1970 | 230 | 205 | 252 | 267 | 284 | 309 | 305 | | 209 | 148 | |
| 1971 | 236 | 211 | 272 | 290 | 313 | 288 | 279 | | 236 | 113 | |
| Third FYP | | | | | | | | | | | |
| 1972 | 232 | 188 | 231 | 261 | 267 | 251 | 255 | | 240 | 110 | |
| 1973 | 235 | 179 | 247 | 239 | 280 | 238 | 270 | incl. in | 264 | 113 | |
| 1974 | 226 | 171 | 259 | 240 | 2786 | 257 | 298 | general | 275 | 116 | |
| 1975 | 221 | 160 | 253 | 223 | 268 | 256 | 271 | cargo | 275 | 118 | |
| 1976 | 228 | 177 | 261 | 224 | 287 | 270 | 260 | | 266 | 125 | |
| Fourth FYP (forecast) | | | | | | | | | | | |
| 1977-81 | 226 | 165 | 260 | 225 | 282 | 270 | 255 | 445 | 270 | 125 | |

Source: KNR and mission.

Table 2.6

KOREA

SIXTH RAILWAY PROJECT

KNR Freight Traffic: 1966-76 Actual and 1977-81 Forecast
(Million ton-km)

| Years | Major Commodities | | | | | | | Others | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Coal | Cement | Ore | Oil | Fertilizer | Grain | Subtotal | General cargo | Container | Military | KNR | Total |
| Actual | | | | | | | | | | | | |
| 1966 | 2,185 | 476 | 269 | 316 | 186 | 318 | 3,750 | 1,186 | | 420 | 94 | 5,450 |
| Second FYP | | | | | | | | | | | | |
| 1967 | 2,306 | 565 | 335 | 423 | 202 | 338 | 4,169 | 1,472 | | 454 | 83 | 6,178 |
| 1968 | 2,125 | 845 | 368 | 589 | 312 | 406 | 4,645 | 1,577 | | 548 | 97 | 6,867 |
| 1969 | 2,397 | 911 | 402 | 624 | 330 | 384 | 5,048 | 1,602 | | 553 | 125 | 7,328 |
| 1970 | 2,785 | 1,003 | 453 | 641 | 312 | 402 | 5,595 | 1,526 | | 439 | 148 | 7,709 |
| 1971 | 2,881 | 1,222 | 435 | 724 | 344 | 403 | 6,009 | 1,281 | | 449 | 102 | 7,841 |
| Third FYP | | | | | | | | | | | | |
| 1972 | 2,620 | 1,125 | 347 | 574 | 347 | 402 | 5,415 | 1,174 | | 575 | 77 | 7,241 |
| 1973 | 3,201 | 1,344 | 568 | 645 | 420 | 381 | 6,559 | 1,486 | Incl. in | 433 | 113 | 8,591 |
| 1974 | 3,408 | 1,336 | 751 | 649 | 525 | 334 | 7,003 | 1,517 | general | 357 | 128 | 9,005 |
| 1975 | 3,688 | 1,437 | 760 | 692 | 590 | 256 | 7,423 | 1,355 | cargo | 385 | 130 | 9,293 |
| 1976 | 3,662 | 1,804 | 889 | 695 | 516 | 352 | 7,918 | 1,248 | | 399 | 163 | 9,728 |
| Forecast | | | | | | | | | | | | |
| Fourth FYP | | | | | | | | | | | | |
| 1977 | 3,865 | 1,815 | 939 | 765 | 564 | 405 | 8,353 | 1,428 | 178 | 405 | 162 | 10,526 |
| 1978 | 4,226 | 1,947 | 1,040 | 833 | 620 | 432 | 9,098 | 1,505 | 267 | 405 | 162 | 11,437 |
| 1979 | 4,565 | 2,013 | 1,238 | 900 | 677 | 459 | 9,852 | 1,581 | 356 | 405 | 162 | 12,356 |
| 1980 | 4,859 | 2,063 | 1,349 | 900 | 733 | 459 | 10,363 | 1,658 | 490 | 405 | 162 | 13,078 |
| 1981 | 5,198 | 2,145 | 1,578 | 1,013 | 761 | 486 | 11,121 | 1,734 | 534 | 405 | 162 | 13,956 |

Source: KNR and mission.

Table 2.7

KOREA

SIXTH RAILWAY PROJECT

KNR Intercity Passenger Traffic: 1966-76 Actual and 1977-81 Forecast

| | Number of Passengers (millions) | | | | Passenger-km (millions) | | | | Average Distance (km) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Commuter | Long distance /a | Military | Total | Commuter | Long distance /a | Military | Total | Commuter | Long distance /a | Military | Total |
| Actual | | | | | | | | | | | | |
| 1966 | 38.4 | 98.0 | 1.9 | 138.3 | 830 | 7,288 | 546 | 8,664 | 21.6 | 74.4 | 285.0 | 62.7 |
| Second FYP | | | | | | | | | | | | |
| 1967 | 41.6 | 108.4 | 1.9 | 151.9 | 883 | 8,150 | 543 | 9,576 | 21.2 | 75.2 | 288.9 | 63.6 |
| 1968 | 38.7 | 110.6 | 1.6 | 150.9 | 828 | 9,280 | 482 | 10,590 | 21.3 | 83.9 | 301.2 | 70.1 |
| 1969 | 37.9 | 114.8 | 2.0 | 154.7 | 799 | 9,680 | 598 | 11,077 | 20.0 | 84.0 | 304.0 | 71.0 |
| 1970 | 38.2 | 91.4 | 1.7 | 131.3 | 854 | 8,425 | 539 | 9,818 | 22.4 | 92.2 | 299.4 | 74.8 |
| 1971 | 41.4 | 85.2 | 1.6 | 128.2 | 940 | 7,300 | 510 | 8,750 | 22.7 | 85.7 | 320.0 | 68.3 |
| Third FYP | | | | | | | | | | | | |
| 1972 | 26.3 | 109.2 | 1.6 | 137.2 | 629 | 8,914 | 519 | 10,062 | 23.9 | 81.6 | 324.4 | 73.3 |
| 1973 | 22.5 | 118.9 | 1.6 | 143.0 | 552 | 9,681 | 487 | 10,720 | 24.5 | 81.4 | 304.4 | 75.0 |
| 1974 | 20.6 | 117.6 | 1.6 | 139.8 | 481 | 9,581 | 471 | 10,533 | 23.4 | 81.4 | 294.4 | 75.3 |
| 1975 | 15.1 | 122.0 | 1.4 | 138.6 | 326 | 10,626 | 434 | 11,386 | 21.6 | 87.1 | 310.0 | 82.1 |
| 1976 | 17.2 | 130.1 | 1.3 | 148.6 | 367 | 11,678 | 395 | 12,440 | 21.3 | 89.8 | 303.8 | 78.6 |
| Forecast | | | | | | | | | | | | |
| Fourth FYP | | | | | | | | | | | | |
| 1977 | 18.2 | 138.0 | 1.4 | 157.6 | 400 | 13,175 | 427 | 14,002 | 22.0 | 96.0 | 305.0 | 88.9 |
| 1978 | 19.3 | 142.0 | 1.4 | 162.7 | 425 | 13,790 | 427 | 14,642 | 22.0 | 97.0 | 305.0 | 90.2 |
| 1979 | 20.0 | 146.3 | 1.4 | 167.9 | 440 | 14,451 | 427 | 15,318 | 22.0 | 99.0 | 305.0 | 91.5 |
| 1980 | 20.0 | 151.3 | 1.4 | 172.7 | 440 | 15,034 | 427 | 15,900 | 22.0 | 99.0 | 305.0 | 92.0 |
| 1981 | 20.0 | 156.1 | 1.4 | 177.5 | 440 | 15,588 | 427 | 16,455 | 22.0 | 100.0 | 305.0 | 92.7 |

/a See detail forecast by type of service, Table 2.9.

Source: KNR and mission.

Table 2.8

KOREA

SIXTH RAILWAY PROJECT

KNR Long Distance Intercity Passenger Traffic by Type of Service
1971-76 Actual, 1977-81 Forecast

| | Number of Passengers (millions) | | | | | Passenger-km (millions) | | | | | Average Distance (km) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Spec. Exp. | Ltd. Exp. | Ord. Exp. | Ord. | Total | Spec. Exp. | Ltd. Exp. | Ord. Exp. | Ord. | Total | Spec. Exp. | Ltd. Exp. | Ord. Exp. | Ord. | Total |
| Actual | | | | | | | | | | | | | | | |
| 1971 | 0.3 | 3.8 | - | 81.7 | 85.8 | 117 | 1,071 | - | 6,112 | 7,300 | 393 | 285 | - | 75 | 85 |
| Third FYP | | | | | | | | | | | | | | | |
| 1972 | 0.4 | 5.9 | - | 102.9 | 109.2 | 147 | 1,653 | - | 7,115 | 8,915 | 383 | 283 | - | 69 | 82 |
| 1973 | 0.5 | 7.6 | - | 110.8 | 118.9 | 183 | 2,105 | - | 7,393 | 9,681 | 374 | 277 | - | 67 | 81 |
| 1974 | 0.6 | 8.8 | 4.4 | 103.8 | 117.6 | 234 | 2,224 | 940 | 6,183 | 9,581 | 367 | 254 | 213 | 60 | 81 |
| 1975 | 0.8 | 11.5 | 4.7 | 104.8 | 121.8 | 298 | 2,862 | 1,004 | 6,463 | 10,627 | 359 | 250 | 203 | 62 | 87 |
| 1976 | 1.3 | 15.0 | 5.4 | 108.3 | 130.1 | 465 | 3,673 | 1,025 | 6,516 | 11,679 | 352 | 245 | 190 | 60 | 90 |
| Forecast | | | | | | | | | | | | | | | |
| Fourth FYP | | | | | | | | | | | | | | | |
| 1977 | 1.7 | 24.0 | 7.6 | 104.7 | 138.0 | 569 | 5,520 | 1,330 | 5,756 | 13,175 | 345 | 230 | 175 | 55 | 96 |
| 1978 | 2.0 | 26.4 | 7.6 | 106.0 | 142.0 | 690 | 5,940 | 1,330 | 5,830 | 13,790 | 345 | 225 | 175 | 55 | 97 |
| 1979 | 2.4 | 29.0 | 7.6 | 107.5 | 146.5 | 828 | 6,380 | 1,330 | 5,913 | 14,451 | 345 | 220 | 175 | 55 | 99 |
| 1980 | 2.9 | 32.0 | 7.6 | 108.8 | 151.3 | 1,000 | 6,720 | 1,330 | 5,984 | 15,034 | 345 | 210 | 175 | 55 | 99 |
| 1981 | 3.5 | 35.0 | 7.6 | 110.0 | 156.1 | 1,208 | 7,000 | 1,330 | 6,050 | 15,588 | 345 | 200 | 175 | 55 | 100 |

Source: KNR and mission.

Table 2.9

Table 2.10

KOREA

SIXTH RAILWAY PROJECT

KNR Seoul Urban (SMESRS) Passenger Traffic
1974-76 Actual and 1977-81 Forecast

| | Number of Passengers (millions) | | | Passenger-km | Average distance |
|---|---|---|---|---|---|
| | Commuter | Noncommuter | Total | (millions) | (km) |
| Actual | | | | | |
| 1974 | 5.9 | 22.7 | 28.6 | 545 | 19.1 |
| 1975 | 17.1 | 65.3 | 82.4 | 1,540 | 18.7 |
| 1976 | 19.1 | 80.5 | 100.2 | 1,865 | 18.6 |
| Forecast | | | | | |
| Fourth FYP | | | | | |
| 1977 | 25.6 | 112.8 | 138.4 | 2,560 | 18.5 |
| 1978 | 71.8 | 107.7 | 179.5 | 3,231 | 18.0 |
| 1979 | 80.7 | 107.0 | 187.7 | 3,285 | 17.5 |
| 1980 | 91.0 | 107.0 | 198.0 | 3,365 | 17.0 |
| 1981 | 104.5 | 104.5 | 209.0 | 3,448 | 16.5 |

Source: KNR

KOREA

SIXTH RAILWAY PROJECT

Selected Operating Statistics

| | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | Index 1976 (1971 = 100) |
|---|---|---|---|---|---|---|---|
| A. System (at end of year) | | | | | | | |
| 1. Route length (km) | 3,199 | 3,121 | 3,133 | 3,143 | 3,144 | 3,144 | 101 |
| (a) Standard gauge (1.435 m) | 3,074 | 3,069 | 3,086 | 3,096 | 3,097 | 3,097 | 101 |
| (b) Narrow gauge (1.067 m) | 125 | 52 | 47 | 47 | 47 | 47 | 38 |
| (c) Double track | 537 | 537 | 537 | 553 | 561 | 567 | 106 |
| (d) Electrified | - | - | 155 | 340 | 402 | 402 | - |
| 2. Number of stations | 589 | 573 | 573 | 565 | 566 | 566 | 96 |
| 3. Average distance between stations (km) | 5.43 | 5.45 | 5.47 | 5.56 | 5.56 | 5.56 | 102 |
| B. Staff (at end of year) | | | | | | | |
| 1. Number of employees | 43,638 | 44,344 | 41,202 | 39,911 | 39,560 | 39,293 | 90 |
| (a) Permanent | 36,067 | 35,914 | 33,748 | 33,594 | 33,758 | 33,481 | 93 |
| (b) Temporary | 7,571 | 8,430 | 7,454 | 6,317 | 5,807 | 5,812 | 77 |
| C. Rolling Stock /a | | | | | | | |
| 1. Steam locomotives /b | | | | | | | |
| (a) In fleet, number | 80 | 80 | 60 | 51 | 41 | 25 | 31 |
| (b) Available, number | 56 | 56 | 43 | 38 | 32 | 12 | 21 |
| (c) Available, % | 70.0 | 70.0 | 71.7 | 74.5 | 78.0 | 48.0 | 69 |
| 2. Diesel locomotives, main line | | | | | | | |
| (a) In fleet, number | 296 | 295 | 295 | 295 | 300 | 330 | 111 |
| (b) Available, number | 245 | 259 | 259 | 264 | 260 | 285 | 116 |
| (c) Available, % | 82.8 | 87.8 | 87.8 | 89.5 | 86.7 | 86.4 | 104 |
| 3. Diesel locomotives, shunters | | | | | | | |
| (a) In fleet, number | 38 | 41 | 41 | 41 | 41 | 41 | 108 |
| (b) Available, number | 34 | 39 | 39 | 39 | 39 | 36 | 106 |
| (c) Available, % | 89.5 | 95.1 | 95.1 | 95.1 | 95.1 | 87.8 | 98 |
| 4. Electric locomotives, main line | | | | | | | |
| (a) In fleet, number | - | - | 37 | 49 | 66 | 65 | |
| (b) Available, number | - | - | 31 | 42 | 56 | 55 | |
| (c) Available, % | - | - | 83.8 | 85.7 | 84.8 | 84.6 | |
| 5. Diesel railcars, powered units | | | | | | | |
| (a) In fleet, number | 156 | 155 | 152 | 121 | 119 | 123 | 79 |
| (b) Available number | 109 | 101 | 79 | 71 | 86 | 98 | 90 |
| (c) Available, % | 69.9 | 65.2 | 48.0 | 58.7 | 72.3 | 79.7 | 114 |
| 6. Electric railcars, powered units | | | | | | | |
| (a) In fleet, number | - | - | - | 78 | 126 | 126 | |
| (b) Available, number | - | - | - | 72 | 110 | 114 | |
| (c) Available, % | - | - | - | 92.3 | 87.3 | 90.5 | |
| 7. Passenger cars, including railcar trailers | | | | | | | |
| (a) In fleet, total number | 1,662 | 1,604 | 1,581 | 1,571 | 1,712 | 1,760 | 106 |
| - airconditioned coaches | 55 | 55 | 55 | 55 | 65 | 71 | 129 |
| - other coaches | 1,272 | 1,219 | 1,206 | 1,180 | 1,293 | 1,335 | 104 |
| - sleeping cars | 16 | 16 | 16 | 19 | 27 | 29 | 181 |
| - restaurant cars | 26 | 26 | 26 | 26 | 26 | 24 | 92 |
| - baggage cars | 110 | 109 | 109 | 116 | 122 | 117 | 106 |
| - railcar trailers | 142 | 145 | 145 | 146 | 146 | 144 | 101 |
| - other | 34 | 34 | 30 | 29 | 33 | 40 | 118 |
| (b) Available, total number | 1,412 | 1,357 | 1,387 | 1,388 | 1,515 | 1,559 | 110 |
| (c) Available, % | 85.0 | 84.6 | 82.4 | 88.4 | 88.5 | 88.7 | 104 |
| 8. Freight cars | | | | | | | |
| (a) In fleet, total number (including privately owned cars) | 14,575 | 15,975 | 16,491 | 15,887 | 15,794 | 15,964 | 110 |
| - box cars | 4,850 | 5,391 | 5,343 | 5,128 | 4,993 | 5,096 | 105 |
| - gondolas | 5,663 | 6,073 | 6,546 | 6,264 | 6,380 | 6,548 | 108 |
| - flat cars | 1,252 | 1,585 | 1,755 | 1,656 | 1,572 | 1,416 | 113 |
| - tank cars | 2,137 | 2,289 | 2,264 | 2,234 | 2,266 | 2,379 | 111 |
| - others | 673 | 637 | 583 | 605 | 583 | 525 | 78 |
| (b) Available, total number | 13,038 | 13,845 | 14,543 | 14,251 | 14,358 | 14,259 | 109 |
| (c) Available, % | 89.5 | 86.6 | 88.2 | 89.7 | 90.9 | 89.3 | 100 |
| (d) In fleet, privately owned | 1,367 | 1,389 | 1,385 | 1,407 | 1,422 | 1,445 | 106 |

| | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | Index 1976 (1971 = 100) |
|---|---|---|---|---|---|---|---|
| D. Traffic | | | | | | | |
| 1. Passenger traffic | | | | | | | |
| (a) Number of passengers total (million) | 128.1 | 137.1 | 143.0 | 168.5 | 221.0 | 248.7 | 194 |
| - Seoul suburban (SMESRS) | - | - | - | 28.7 | 82.4 | 100.1 | |
| - Other | 128.1 | 137.1 | 143.0 | 139.8 | 138.6 | 148.5 | 116 |
| (b) Passenger-km (million) | 8,750 | 10,062 | 10,720 | 11,077 | 12,926 | 14,305 | 163 |
| - Seoul suburban (SMESRS) | - | - | - | 545 | 1,540 | 1,865 | - |
| - Other | 8,750 | 10,062 | 10,720 | 10,532 | 11,386 | 12,440 | 142 |
| (c) Average journey, total | 68.3 | 73.4 | 75.0 | 65.7 | 56.5 | 57.5 | 84 |
| - Seoul suburban (SMESRS) | | | | 19.0 | 18.7 | 18.6 | |
| - Other | 68.3 | 73.4 | 75.0 | 75.3 | 82.2 | 83.7 | 123 |
| 2. Freight traffic | | | | | | | |
| (a) Net tons (000) | 31,955 | 31,541 | 37,762 | 39,708 | 42,758 | 43,630 | 137 |
| (b) Net ton-km (million) | 7,841 | 7,241 | 8,591 | 9,005 | 9,293 | 9,728 | 124 |
| (c) Average freight haul | 245 | 230 | 228 | 227 | 217 | 223 | 91 |
| 3. Traffic units (million) | 16,591 | 17,303 | 19,311 | 20,082 | 22,219 | 24,033 | 145 |
| 4. Traffic density | | | | | | | |
| (a) Passenger-km per route km (000) | 2,735 | 3,224 | 3,422 | 3,524 | 4,111 | 4,550 | 166 |
| (b) Freight net ton-km per route km (000) | 2,451 | 2,320 | 2,742 | 2,865 | 2,956 | 3,094 | 126 |
| (c) Traffic units per route km (000) | 5,186 | 5,544 | 6,166 | 6,389 | 7,067 | 7,644 | 147 |
| E. Operations | | | | | | | |
| 1. Train-km (000) | 42,226 | 44,528 | 46,017 | 46,790 | 51,022 | 55,393 | 131 |
| (a) According to types of train: | | | | | | | |
| (i) Passenger (incl. railcars) | 24,455 | 27,602 | 27,794 | 27,669 | 31,123 | 34,807 | 142 |
| (ii) Freight | 17,771 | 16,926 | 18,223 | 19,121 | 19,899 | 20,586 | 116 |
| (b) According to types of traction: | | | | | | | |
| (i) Steam locomotive | 976 | 257 | 240 | 105 | 69 | 45 | 5 |
| (ii) Diesel locomotive | 35,426 | 38,808 | 39,665 | 38,015 | 37,876 | 41,326 | 117 |
| (iii) Electric locomotive | - | - | 2,145 | 4,449 | 5,336 | 5,475 | - |
| (iv) Diesel railcar | 5,824 | 5,463 | 3,967 | 3,204 | 4,380 | 4,662 | 80 |
| (v) Electric railcar | - | - | - | 1,017 | 3,361 | 3,885 | - |
| 2. Engine-km, excluding shunting | 52,887 | 53,812 | 53,702 | 58,457 | 76,923 | 84,781 | 160 |
| (a) Steam locomotives | 1,291 | 365 | 290 | 148 | - | - | 0 |
| (b) Diesel locomotives | 39,310 | 41,356 | 41,812 | 40,051 | 39,870 | 43,324 | 112 |
| (c) Electric locomotives | - | - | 2,227 | 4,625 | 6,242 | 6,509 | - |
| (d) Diesel railcars | 12,286 | 12,091 | 9,373 | 8,221 | 10,647 | 11,641 | 95 |
| (e) Electric railcars | - | - | - | 5,412 | 20,164 | 23,307 | - |
| 3. Rolling stock-km (million) | | | | | | | |
| (a) Passenger cars, total | 178 | 204 | 208 | 213 | 241 | 265 | 149 |
| (b) Freight cars, total | 332 | 322 | 372 | 374 | 385 | 402 | 121 |
| - loaded | 208 | 180 | 200 | 201 | 208 | 217 | 104 |
| - empty /c | 124 | 142 | 172 | 173 | 176 | 185 | 149 |
| 4. Loanded freight cars forwarded (000) | 847 | 782 | 883 | 888 | 966 | 972 | 117 |
| 5. Average freight car turnaround time (days) | 5.6 | 6.5 | 6.0 | 5.9 | 5.4 | 5.4 | 93 |
| 6. Average freight car turnaround distance (m) | 392 | 412 | 421 | 421 | 399 | 414 | 105 |

| | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | Index 1976 (1971 = 100) |
|---|---|---|---|---|---|---|---|
| F. Performance Indicators | | | | | | | |
| 1. Passenger traffic | | | | | | | |
| (a) Average number of passengers per passenger train | 358 | 364 | 386 | 400 | 415 | 411 | 115 |
| (b) Average number of passengers per passenger car | 49.2 | 49.3 | 51.5 | 52.0 | 53.6 | 54.0 | 110 |
| 2. Freight traffic | | | | | | | |
| (a) Average number of freight cars per freight train | 18.7 | 19.0 | 20.4 | 19.6 | 19.3 | 19.5 | 104 |
| - loaded | 11.7 | 10.6 | 11.0 | 10.5 | 10.5 | 10.5 | 90 |
| - empty | 7.0 | 8.4 | 9.4 | 9.1 | 8.8 | 9.0 | 128 |
| (b) Average freight train loan (net tons) | 441 | 428 | 471 | 471 | 467 | 472 | 107 |
| (c) Average load per loaded freight car (net tons) | 37.7 | 40.3 | 42.8 | 44.8 | 44.6 | 44.9 | 119 |
| (d) Net ton-km per available freight car (000) | 601 | 523 | 590 | 632 | 647 | 682 | 113 |
| 3. Staff | | | | | | | |
| (a) Traffic units per employee (000) | 379 | 393 | 451 | 495 | 561 | 612 | 161 |
| (b) Employees per route-km | 13.7 | 14.1 | 13.7 | 12.98 | 12.6 | 12.5 | 91 |
| 4. Rolling stock | | | | | | | |
| (a) Availability (%): | | | | | | | |
| (i) Steam locomotives | 70.0 | 70.0 | 71.7 | 74.5 | 78.0 | 48.0 | 69 |
| (ii) Diesel locomotives, main line | 82.8 | 87.8 | 87.8 | 89.5 | 86.7 | 86.4 | 104 |
| (iii) Electric locomotives | - | - | 83.8 | 85.7 | 84.8 | 84.6 | |
| (iv) Diesel railcars, powered units | 69.9 | 65.2 | 48.0 | 58.7 | 72.3 | 79.7 | 114 |
| (v) Electric railcars, powered units | - | - | - | 92.3 | 87.3 | 90.5 | |
| (vi) Passenger cars | 85.0 | 84.6 | 87.4 | 88.4 | 88.5 | 88.7 | 104 |
| (vii) Freight cars | 89.5 | 86.6 | 88.2 | 89.7 | 90.9 | 89.3 | 100 |
| (b) Yearly distance covered per available unit: (km 000) | | | | | | | |
| (i) Diesel main line locomotives | 160 | 160 | 161 | 152 | 153 | 152 | 95 |
| (ii) Electric main line locomotives | - | - | 72 | 110 | 111 | 118 | |
| (iii) Diesel railcars | 113 | 120 | 119 | 116 | 123 | 119 | 105 |
| (iv) Electric railcars | - | - | - | 75 | 183 | 204 | |
| (v) Passenger cars | 126 | 150 | 150 | 153 | 159 | 170 | 135 |
| (vi) Freight cars | 25.4 | 23.2 | 25.6 | 26.2 | 26.8 | 28.2 | 111 |
| (c) Passenger-km per available passenger car, including rail cars (000) | 5,722 | 6,901 | 7,312 | 7,235 | 7,528 | 8,077 | 141 |
| (d) Net ton-km per available freight car (000) | 601 | 523 | 591 | 632 | 647 | 682 | 113 |

/a Number in fleet is average of number at beginning and end of year. Available number is average number during year.

/b Excluding locomotives kept in reserve.

/c Including cabooses.

Source: KNR.

KOREA

SIXTH RAILWAY PROJECT

Freight Tariffs
(Effective January 1, 1977)

| Class | Commodities | Car-load rates in Won per ton for each 50 km Prior to Jan. 1, 1977 | Car-load rates in Won per ton for each 50 km From Jan. 1, 1977 |
|---|---|---|---|
| 1 | Gasoline, cattle, textiles, clothing, furniture, meat and dangerous goods /a, | 312 | 312 |
| | plus sugar, cotton, plywood, hardboard, tobacco /b | 270 | 312 |
| 2 | Cement, diesel and bunker oils, fruits and vegetables /c | 237 | 283 |
| 3 | Lumber, rice, grains, salt, fertilizer, limestone, ores, pulp, asphalt, bricks /d | 207 | 258 |
| 4 | Coal /e | 187 | 237 |

/a In addition, dangerous goods have a 10% surcharge.

/b These commodities previously rated as Class 2.

/c Previously Class 3.

/d Previously Class 4.

/e Previously Class 5.

(a) Tariffs are straight line, in direct proportion to distance travelled (i.e. no taper for distance) and rates are quoted in increments for each block of 50 kilometers. Intermediate distances are charged at the next highest 50 km level (i.e. 227 km charged at 250 km rate).

(b) There is a Won 14,220 minimum charge, to help cover basic non-distance related charges (i.e. terminal costs); it also introduces a slight distance taper on a rate per ton-km basis.

(c) Car-load charges are billed at a minimum car-load weight which is usually equivalent to the practical capacity of the car for the particular commodity density. In addition, these minimum charges effectively penalize the use of smaller freight cars (under 30 tons) for hauls up to 100 km.

(d) Miscellaneous charges include:

(i) Switching - W 1,877 per km per movement.

(ii) Demurrage - W 120 per ton for each 6 hours (after first 6 hours free use).

(iii) Storage - W 476 per ton (car-load basis) each 24 hours.

Source: KNR

KOREA

SIXTH RAILWAY PROJECT

Passenger Tariffs
(Effective January 6, 1977)

| | Basic fare | Minimum charge |
|---|---|---|
| Ordinary | W 2.51 per pass/km | W 40 (up to 17 km) |
| Ordinary express | W 3.76 " " " | W 200 (up to 54 km) |
| Limited express | W 4.87 " " " | W 500 (up to 103 km) |
| Special express | W 9.41 " " " | W 1,040 (up to 111 km) |

In addition there are:

| | Up to 200 km | 201 to 400 km | Over 400 km |
|---|---|---|---|
| (a) Seat charges | | | |
| Limited express - | W 300 | W 500 | W 700 |
| Special express - | W 500 | W 750 | W 1,000 |

(b) Sleeper charges - upper berth - W 2,000
lower berth - W 2,700

(c) For commuters:

(i) Students can buy one month, or three monthly tickets (can be used 50 times in one month), with minimum charges of W 1,090 (one month), or W 3,270 (three months), for journeys up to 18 km. Thereafter, the charge is on a straight line kilometrage basis at W 1.21 per pass-km.

(ii) Nonstudents can buy monthly or three monthly tickets (but which can be used 60 times in one month) with minimum charges of W 1,880 or W 5,640, respectively, also for journeys up to 18 km. Thereafter, the straight line kilometrage charge is at W 1.74 per pass-km, i.e. a 30% discount over the ordinary basic fare.

Source: KNR

KOREA

SIXTH RAILWAY PROJECT

Tariff Increases Granted During 1967-77 Period

| Year | Freight rates increase | Average revenue per ton-km (Won) | Passenger fares increase | Average revenue per pass-km (Won) |
|---|---|---|---|---|
| 1967 | 30% (October) | 1.19 | 50% (October) | 1.12 |
| 1968 | - | 1.42 | - | 1.46 |
| 1969 | - /a | 1.52 | 30% (December) | 1.64 |
| 1970 | - | 1.45 | - | 1.97 |
| 1971 | - | 1.48 | - | 1.98 |
| 1972 | 20% (February) | 1.84 | - /b | 2.06 |
| 1973 | - | 1.84 | - | 2.14 |
| 1974 | 10% (January)<br>5% (February<br>35-40% (December) /d | 2.17 | 25% (February) /c | 2.68 |
| 1975 | 10% (July) /e | 3.22 | 20% (July) | 3.22 |
| 1976 | 35% (January) /f | 4.64 | | 3.67 |
| 1977 | (January) /g | 5.20 | | |

/a Changes were made in commodity classification only.

/b There were reductions in commuter ticket discounts.

/c In addition, KNR allowed to retain the 10% transportation tax on passenger fares, in force since 1963.

/d Selective increases, including coal.

/e Excluding coal.

/f Excluding coal but on April 1, coal raised to Class 5.

/g Existing five classes compressed to four (see Table 2.12).

Source: KNR

KOREA

SIXTH RAILWAY PROJECT

Traffic Revenues and Costs - 1976
(Won million)

| | Operating revenues (1) | Operating Costs: Fully distributed (2) | Operating Costs: Variable (3) | Net revenue (loss) (1-2) (4) | Contributions to overheads (5) (1-3) | Operating ratio (%) (6) |
|---|---|---|---|---|---|---|
| Passengers | | | | | | |
| Saemaul Express | 3,734 | 2,361 | 1,611 | 1,373 | 2,123 | 63.2 |
| Limited Express | 18,519 | 12,279 | 8,521 | 6,240 | 9,998 | 66.3 |
| Ordinary Express | 4,834 | 5,427 | 4,109 | (593) | 725 | 112.3 |
| Ordinary | 22,941 | 28,702 | 19,432 | (5,761) | 3,509 | 125.1 |
| Military | 1,085 | 1,083 | 788 | 2 | 297 | 99.8 |
| Commuters | 1,431 | 2,871 | 1,815 | (1,440) | (384) | 200.6 |
| Baggage | 2,923 | 3,941 | 2,759 | (1,018) | 164 | 134.8 |
| Total | 55,467 | 56,664 | 39,035 | (1,197) | 16,432 | 102.2 |
| Average per pass-km | 3.67 | 3.69 | 2.54 | | | |
| Freight | | | | | | |
| Coal | 14,143 | 18,722 | 12,049 | (4,579) | 2,094 | 132.4 |
| Cement | 9,815 | 9,309 | 5,872 | 506 | 3,943 | 94.8 |
| Ores | 3,904 | 4,718 | 3,071 | (814) | 833 | 120.9 |
| Oil | 3,482 | 3,781 | 2,455 | (299) | 1,027 | 108.6 |
| Fertilizer | 2,368 | 3,504 | 2,317 | (1,136) | 51 | 148.0 |
| Grain | 1,660 | 2,667 | 1,769 | (1,007) | (109) | 160.7 |
| Miscellaneous | 6,597 | 8,267 | 5,152 | (1,670) | 1,445 | 125.3 |
| Military | 1,517 | 3,338 | 2,221 | (1,821) | (704) | 220.0 |
| KNR | 1,609 | 1,647 | 1,332 | (38) | 277 | 102.5 |
| Total | 45,095 | 55,953 | 36,238 | (10,858) | 8,857 | 124.1 |
| Average per ton-km | 4.64 | 5.76 | 3.73 | | | |

Source: KNR.

KOREA

APPRAISAL OF A SIXTH HIGHWAY PROJECT

Uneconomic Lines and Stations

A. Uneconomic Lines

| Line | Length | 1975 Operating ratio % | Cost saving if closed (W million) | Remarks |
|---|---|---|---|---|
| Su In | 65.1 km | 603 | 490 | Narrow gauge line, adequate highway available. |
| Jin Sam | 34.8 km | 642 | 171 | Line to military port. |
| An Seong | 29.8 km | 458 | 74 | Adequate highway available. |
| Og Gu | 11.8 km | 814 | 42 | Line to military airport. |
| Hwa Sun | 11.1 km | 590 | 52 | Used by Korea Coal Corporation. |
| Kim Po | 9.2 km | n.a. | 29 | Used by U.S. military forces. |
| Yong San | 2.4 km | 436 | 34 | Used by Korea Electric Co. |
| | 164.2 km | | 862 | |

B. Uneconomic Stations

1. Passengers and freight. The following stations where passengers and freight services earn revenues covering less than 30% of personnel costs involved are regarded as operating uneconomic services. KNR proposes action to discontinue services, simplify operations, or close stations, as under:

(i) Passenger services

| | | | |
|---|---|---|---|
| 1977 | 30 stations | - ratio of revenues to personnel costs: | 12% /a |
| 1978 | 60 " | - " " " " " " " : | 18% |
| 1979 | 55 " | - " " " " " " " : | 26% |
| | 145 stations | | |

(ii) Freight services

| | | | |
|---|---|---|---|
| 1977 | 25 stations | - ratio of revenues to personnel costs: | 4% /b |
| 1978 | 21 " | - " " " " " " " : | 5% |
| 1979 | 51 " | - " " " " " " " : | 14% |
| | 97 stations | | |

2. Baggage services. At the following stations, where the revenues fail to cover 100% of the personnel costs involved, KNR proposes action similar to (1) above, as under:

| | | | |
|---|---|---|---|
| 1977 | 110 stations | - ratio of revenues to personnel costs: | 72% /c |
| 1978 | 81 " | - " " " " " " " : | 66% |
| 1979 | 39 " | - " " " " " " " : | 84% |
| | 230 stations | | |

/a Actual performance in 1977 - 14 closed
/b " " " " - 26 closed
/c " " " " - 92 discontinued

Source: KNR

KOREA

Table 3.1

SIXTH RAILWAY PROJECT

KNR Investment Plan 1977-81

| | 1977 | | | 1978 | | | 1979 | | | 1980 | | | 1981 | | | Total expenditure 1977-81 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total |
| | ---- Won million ---- | | | | | | | | | | | | | | | ---- US$'000 ---- | | | | | |
| 1 New Line Construction | | | | | | | | | | | | | | | | | | | | | |
| 1.1 Industrial sidings (5 places) | 1,000 | - | 1,000 | 2,300 | - | 2,300 | 1,300 | - | 1,300 | 3,420 | - | 3,420 | 2,949 | - | 2,949 | 10,969 | - | 10,969 | 22,616 | - | 22,616 |
| Subtotal Category 1 | 1,000 | - | 1,000 | 2,300 | - | 2,300 | 1,300 | - | 1,300 | 3,420 | - | 3,420 | 2,949 | - | 2,949 | 10,969 | - | 10,969 | 22,616 | - | 22,616 |
| 2 Electrification | | | | | | | | | | | | | | | | | | | | | |
| 2.1 Seoul-Susaeg (8.5 km) | - | - | - | - | - | - | 800 | 840 | 1,640 | - | - | - | - | - | - | 800 | 840 | 1,640 | 1,650 | 1,732 | 3,382 |
| 2.2 Jecheon-Yeongju (64 km) | - | - | - | - | - | - | - | - | - | 1,695 | 1,510 | 3,205 | 1,973 | 1,606 | 3,579 | 3,668 | 3,116 | 6,784 | 7,563 | 6,425 | 13,988 |
| 2.3 Industrial sidings | 224 | - | 224 | - | - | - | - | - | - | - | - | - | - | - | - | 224 | - | 224 | 462 | - | 462 |
| Subtotal Category 2 | 224 | - | 224 | - | - | - | 800 | 840 | 1,640 | 1,695 | 1,510 | 3,205 | 1,973 | 1,606 | 3,579 | 4,692 | 3,956 | 8,648 | 9,675 | 8,157 | 17,832 |
| 3 Increase in Station and Line Capacity | | | | | | | | | | | | | | | | | | | | | |
| 3.1 Double tracking (about 90 km) | 5,000 | 500 | 5,500 | 3,100 | 425 | 3,525 | 8,292 | 940 | 9,232 | 8,927 | 3,234 | 12,161 | 7,210 | 1,420 | 8,630 | 32,529 | 6,519 | 39,048 | 67,071 | 13,441 | 80,512 |
| 3.2 Bypass lines (4 places) | 1,742 | 88 | 1,830 | 1,009 | 78 | 1,087 | 552 | 77 | 629 | 600 | - | 600 | 1,216 | 286 | 1,502 | 5,119 | 529 | 5,648 | 10,555 | 1,091 | 11,646 |
| 3.3 Additional crossing loops (41 places) | 1,710 | - | 1,710 | 1,903 | 162 | 2,065 | 574 | 126 | 700 | 574 | 126 | 700 | 574 | 126 | 700 | 5,335 | 540 | 5,875 | 11,000 | 1,113 | 12,113 |
| 3.4 Marshalling yard extensions (4 places) | 1,100 | - | 1,100 | 2,098 | 162 | 2,260 | 1,430 | 170 | 1,600 | 1,540 | 60 | 1,600 | - | - | - | 6,168 | 392 | 6,560 | 12,718 | 808 | 13,526 |
| 3.5 Station yard extensions (12 places) | - | - | - | 508 | 82 | 590 | 253 | 57 | 310 | 251 | 64 | 315 | 296 | 60 | 356 | 1,308 | 263 | 1,571 | 2,697 | 543 | 3,240 |
| 3.6 Freight handling facilities | 368 | - | 368 | 300 | - | 300 | 900 | - | 900 | 1,350 | - | 1,350 | 1,150 | - | 1,150 | 4,068 | - | 4,068 | 8,387 | - | 8,387 |
| 3.7 Lengthening of crossing loops (18 places) | 392 | - | 392 | - | - | - | 264 | 45 | 309 | 616 | 105 | 721 | 352 | 60 | 412 | 1,624 | 210 | 1,834 | 3,348 | 433 | 3,781 |
| 3.8 Station installations | 2,730 | - | 2,730 | 1,819 | 110 | 1,929 | 2,248 | - | 2,248 | 3,048 | - | 3,048 | 974 | - | 974 | 10,819 | 110 | 10,929 | 22,308 | 227 | 22,535 |
| 3.9 Signaling | 1,747 | 1,026 | 2,773 | 986 | - | 986 | 4,014 | - | 4,014 | 4,885 | - | 4,885 | 6,623 | - | 6,623 | 18,255 | 1,026 | 19,281 | 37,640 | 2,115 | 39,755 |
| 3.10 Busan area improvement | - | - | - | - | - | - | 200 | - | 200 | 811 | 62 | 873 | - | - | - | 1,011 | 62 | 1,073 | 2,084 | 128 | 2,212 |
| Subtotal Category 3 | 14,789 | 1,614 | 16,403 | 11,723 | 1,019 | 12,742 | 18,727 | 1,415 | 20,142 | 22,602 | 3,651 | 26,253 | 18,395 | 1,952 | 20,347 | 86,236 | 9,651 | 95,887 | 177,808 | 19,899 | 197,707 |
| 4 Way and Structures | | | | | | | | | | | | | | | | | | | | | |
| 4.1 Rail renewal, 50 kg rails (840 km) | 1,100 | 3,400 | 4,500 | 743 | 2,295 | 3,038 | 687 | 2,125 | 2,812 | 440 | 1,360 | 1,800 | 550 | 1,700 | 2,250 | 3,520 | 10,880 | 14,400 | 7,258 | 22,432 | 29,690 |
| 4.2 Rail renewal, 60 kg rails (30 km) | - | - | - | - | - | - | - | - | - | 165 | 612 | 777 | - | - | - | 165 | 612 | 777 | 340 | 1,262 | 1,602 |
| 4.3 Track renewal, 50 kg rails (140 km) | 650 | 340 | 990 | 975 | 510 | 1,485 | 1,300 | 680 | 1,980 | 650 | 340 | 990 | 975 | 510 | 1,485 | 4,550 | 2,380 | 6,930 | 9,382 | 4,908 | 14,290 |
| 4.4 Track renewal, 60 kg rails (60 km) | - | - | - | - | - | - | - | - | - | 975 | 612 | 1,587 | 975 | 612 | 1,587 | 1,950 | 1,224 | 3,174 | 4,021 | 2,524 | 6,545 |
| 4.5 Concrete sleepers (400,000) | 675 | - | 675 | 675 | - | 675 | 1,350 | - | 1,350 | 1,350 | - | 1,350 | 1,350 | - | 1,350 | 5,400 | - | 5,400 | 11,135 | - | 11,135 |
| 4.6 Points and crossings (980) | 200 | 250 | 450 | 350 | - | 350 | 350 | - | 350 | 300 | 120 | 420 | 300 | 120 | 420 | 1,500 | 490 | 1,990 | 3,093 | 1,011 | 4,104 |
| 4.7 Ballast (640,000 cu m) | - | - | - | 640 | - | 640 | 640 | - | 640 | 640 | - | 640 | 640 | - | 640 | 2,560 | - | 2,560 | 5,278 | - | 5,278 |
| 4.8 Bridge strengthening (170 spans) | 712 | - | 712 | 146 | - | 146 | 226 | - | 226 | 30 | - | 30 | - | - | - | 1,114 | - | 1,114 | 2,297 | - | 2,297 |
| 4.9 Tunnel strengthening | 135 | - | 135 | 250 | - | 250 | 150 | - | 150 | 150 | - | 150 | 200 | - | 200 | 885 | - | 885 | 1,825 | - | 1,825 |
| 4.10 Level crossings | 1,321 | - | 1,321 | 5,190 | - | 5,190 | 2,720 | - | 2,720 | 2,660 | - | 2,660 | 2,660 | - | 2,660 | 14,551 | - | 14,551 | 30,002 | - | 30,002 |
| 4.11 Permanent way workshop and equipment | 421 | 1,086 | 1,507 | 300 | 1,075 | 1,375 | 188 | 474 | 662 | - | - | - | - | - | - | 909 | 2,635 | 3,544 | 1,874 | 5,433 | 7,307 |
| 4.12 Miscellaneous | 290 | - | 290 | 1,940 | - | 1,940 | 2,097 | - | 2,097 | 210 | - | 210 | 320 | - | 320 | 4,857 | - | 4,857 | 10,014 | - | 10,014 |
| Subtotal Category 4 | 5,504 | 5,076 | 10,580 | 11,209 | 3,880 | 15,089 | 9,708 | 3,279 | 12,987 | 7,570 | 3,044 | 10,614 | 7,970 | 2,942 | 10,912 | 41,961 | 18,221 | 60,182 | 86,519 | 37,570 | 124,089 |
| 5 Motive Power and Rolling Stock | | | | | | | | | | | | | | | | | | | | | |
| 5.1 New diesel main line locomotives (42) | - | - | - | 100 | 7,300 | 7,400 | 50 | 3,650 | 3,700 | 25 | 1,825 | 1,850 | 35 | 2,555 | 2,590 | 210 | 15,330 | 15,540 | 433 | 31,609 | 32,042 |
| 5.2 New diesel shunting locomotives (13) | - | - | - | - | - | - | - | - | - | 30 | 1,020 | 1,050 | 35 | 1,190 | 1,225 | 65 | 2,210 | 2,275 | 134 | 4,556 | 4,690 |
| 5.3 New electric locomotives (20) | 898 | 9,206 | 10,104 | - | - | - | - | - | - | - | - | - | - | - | - | 898 | 9,206 | 10,104 | 1,852 | 18,981 | 20,833 |
| 5.4 New electric railcars (90) | 8,150 | - | 8,150 | 9,021 | - | 9,021 | - | - | - | - | - | - | - | - | - | 17,171 | - | 17,171 | 35,404 | - | 35,404 |
| 5.5 New breakdown cranes (4) | - | - | - | 26 | 700 | 726 | - | - | - | - | - | - | 26 | 700 | 726 | 52 | 1,400 | 1,452 | 108 | 2,886 | 2,994 |
| 5.6 Motive power remodeling (351 units) | 1,682 | 4,723 | 6,405 | 1,716 | 6,378 | [1]8,094 | 1,010 | 2,889 | 3,899 | 1,745 | 4,500 | 6,245 | 1,168 | 3,840 | 5,008 | 7,321 | 22,330 | 29,651 | 15,094 | 46,042 | 61,136 |
| 5.7 New passenger cars (442) | 3,038 | 690 | 3,728 | 3,116 | 15,580 | 18,696 | 1,098 | 5,490 | 6,588 | 1,844 | 9,220 | 11,064 | 1,624 | 8,120 | 9,744 | 10,720 | 39,100 | 49,820 | 22,104 | 80,620 | 102,724 |
| 5.8 Passenger car remodeling (225) | - | - | - | 214 | - | 214 | 207 | - | 207 | 371 | - | 371 | 403 | - | 403 | 1,195 | - | 1,195 | 2,464 | - | 2,464 |
| 5.9 New freight cars (3,270) | - | 5,819 | 5,819 | - | 12,585 | 12,585 | - | 10,200 | 10,200 | - | 7,450 | 7,450 | - | 7,435 | 7,435 | - | 43,489 | 43,489 | - | 89,669 | 89,669 |
| 5.10 Freight car remodeling (2,825) | 396 | - | 396 | 2,129 | - | 2,129 | 2,026 | - | 2,026 | 2,061 | - | 2,061 | 1,965 | - | 1,965 | 8,577 | - | 8,577 | 17,685 | - | 17,685 |
| Subtotal Category 5 | 14,164 | 20,438 | 34,602 | 16,322 | 42,543 | 58,865 | 4,391 | 22,229 | 26,620 | 6,076 | 24,015 | 30,091 | 5,256 | 23,840 | 29,096 | 46,209 | 133,065 | 179,274 | 95,278 | 274,363 | 369,641 |
| 6 Rolling Stock Repair Facilities | | | | | | | | | | | | | | | | | | | | | |
| 6.1 New Daejeon car shops | 846 | 1,002 | 1,848 | 2,249 | 1,501 | 3,750 | 2,000 | - | 2,000 | 2,000 | 1,700 | 3,700 | 4,000 | 800 | 4,800 | 11,095 | 5,003 | 16,098 | 22,875 | 10,316 | 33,191 |
| 6.2 Improvement of existing backshops | 50 | - | 50 | 310 | 1,450 | 1,760 | 550 | 600 | 1,150 | 400 | 500 | 900 | - | - | - | 1,310 | 2,550 | 3,860 | 2,701 | 5,258 | 7,959 |
| 6.3 Improvement of existing shops | 273 | 252 | 525 | 810 | 270 | 1,080 | 1,390 | 580 | 1,970 | 472 | 140 | 612 | 335 | 70 | 405 | 3,280 | 1,312 | 4,592 | 6,763 | 2,705 | 9,468 |
| Subtotal Category 6 | 1,169 | 1,254 | 2,423 | 3,369 | 3,221 | 6,590 | 3,940 | 1,180 | 5,120 | 2,872 | 2,340 | 5,212 | 4,335 | 870 | 5,205 | 15,685 | 8,865 | 24,550 | 32,339 | 18,279 | 50,618 |
| 7 Telecommunications, Power Facilities, Buildings and Others | | | | | | | | | | | | | | | | | | | | | |
| 7.1 Telecommunications | 582 | 171 | 753 | 625 | - | 625 | 459 | - | 459 | 284 | - | 284 | 212 | - | 212 | 2,162 | 171 | 2,333 | 4,458 | 353 | 4,811 |
| 7.2 Power facilities | 110 | - | 110 | 560 | 35 | 595 | 320 | 15 | 335 | 200 | 5 | 205 | 200 | 5 | 205 | 1,390 | 60 | 1,450 | 2,866 | 124 | 2,990 |
| 7.3 Buildings | - | - | - | 510 | - | 510 | 560 | - | 560 | - | - | - | 685 | - | 685 | 1,755 | - | 1,755 | 3,619 | - | 3,619 |
| 7.4 Housing facilities | 653 | - | 653 | 880 | - | 880 | 442 | - | 442 | 1,365 | - | 1,365 | 1,000 | - | 1,000 | 4,340 | - | 4,340 | 8,948 | - | 8,948 |
| 7.5 Miscellaneous | 3,159 | 613 | 3,772 | 1,450 | 283 | 1,733 | 1,150 | 150 | 1,300 | 1,150 | 150 | 1,300 | 1,150 | 150 | 1,300 | 8,059 | 1,346 | 9,405 | 16,617 | 2,775 | 19,392 |
| Subtotal Category 7 | 4,504 | 784 | 5,288 | 4,025 | 318 | 4,343 | 2,931 | 165 | 3,096 | 2,999 | 155 | 3,154 | 3,247 | 155 | 3,402 | 17,706 | 1,577 | 19,283 | 36,508 | 3,252 | 39,760 |
| Total Category 1-7 | 41,354 | 29,166 | 70,520 | 48,948 | 50,981 | 99,929 | 41,797 | 29,108 | 70,905 | 47,234 | 34,715 | 81,949 | 44,125 | 31,365 | 75,490 | 223,458 | 175,335 | 398,793 | 460,743 | 361,520 | 822,263 |
| 8 Physical contingencies (10% except for items 4.1-4.4, 4.11 and Category 5) | 2,544 | 499 | 3,043 | 3,061 | 456 | 3,517 | 3,523 | 360 | 3,883 | 3,893 | 778 | 4,671 | 3,637 | 470 | 4,107 | 16,658 | 2,563 | 19,221 | 34,348 | 5,283 | 39,631 |
| 9 Price contingencies (for local currency items 8% annually in 1977/78, 7.5% in 1979 and 7% in 1980/81; for foreign currency items 8% annually in 1977, 7% in 1978, 6.5% in 1979 and 6% in 1980/81) | 1,756 | 1,187 | 2,943 | 6,407 | 6,069 | 12,476 | 9,527 | 5,702 | 15,229 | 15,230 | 9,516 | 24,746 | 18,570 | 10,957 | 29,527 | 51,490 | 33,431 | 84,921 | 106,167 | 68,931 | 175,098 |
| GRAND TOTAL | 45,654 | 30,852 | 76,506 | 58,416 | 57,506 | 115,922 | 54,847 | 35,170 | 90,017 | 66,357 | 45,009 | 111,366 | 66,332 | 42,792 | 109,124 | 291,606 | 211,329 | 502,935 | 601,258 | 435,734 | 1,036,992 |

Note: US$1.00 = 485 won.

Source: KNR and mission.

KOREA

Table 3.2

SIXTH RAILWAY PROJECT

KNR Investment Plan 1977-81, Items Starting in 1977 or Before

| | 1977 | | | 1978 | | | 1979 | | | 1980 | | | Total expenditure 1977-80 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total |
| | Won million | | | | | | | | | | | | | | | US$'000 | | |
| 1 New Line Construction | | | | | | | | | | | | | | | | | | |
| 1.1 Industrial sidings | 1,000 | - | 1,000 | 1,300 | - | 1,300 | - | - | - | - | - | - | 2,300 | - | 2,300 | 4,742 | - | 4,742 |
| Subtotal Category 1 | 1,000 | - | 1,000 | 1,300 | - | 1,300 | - | - | - | - | - | - | 2,300 | - | 2,300 | 4,742 | - | 4,742 |
| 2 Electrification | | | | | | | | | | | | | | | | | | |
| 2.1 Industrial sidings | 224 | - | 224 | - | - | - | - | - | - | - | - | - | 224 | - | 224 | 462 | - | 462 |
| Subtotal Category 2 | 224 | - | 224 | - | - | - | - | - | - | - | - | - | 224 | - | 224 | 462 | - | 462 |
| 3 Increase in Station and Line Capacity | | | | | | | | | | | | | | | | | | |
| 3.1 Double tracking (about 27 km) | 5,000 | 500 | 5,500 | 3,100 | 425 | 3,525 | 4,000 | 750 | 4,750 | - | - | - | 12,100 | 1,675 | 13,775 | 24,948 | 3,454 | 28,402 |
| 3.2 Bypass lines (2 places) | 1,742 | 88 | 1,830 | 809 | 78 | 887 | - | - | - | - | - | - | 2,551 | 166 | 2,717 | 5,260 | 342 | 5,602 |
| 3.3 Additional crossing loops (10 places) | 1,710 | - | 1,710 | 1,065 | - | 1,065 | - | - | - | - | - | - | 2,775 | - | 2,775 | 5,722 | - | 5,722 |
| 3.4 Marshalling yard extensions (2 places) | 1,100 | - | 1,100 | 910 | 90 | 1,000 | 1,210 | 90 | 1,300 | 740 | 60 | 800 | 3,960 | 240 | 4,200 | 8,165 | 495 | 8,660 |
| 3.5 Freight handling facilities (container yards) | 368 | - | 368 | - | - | - | - | - | - | - | - | - | 368 | - | 368 | 759 | - | 759 |
| 3.6 Lengthening of crossing loops (4 places) | 392 | - | 392 | - | - | - | - | - | - | - | - | - | 392 | - | 392 | 808 | - | 808 |
| 3.7 Station improvements (16 places) | 2,730 | - | 2,730 | 980 | - | 980 | 700 | - | 700 | 1,374 | - | 1,374 | 5,784 | - | 5,784 | 11,926 | - | 11,926 |
| 3.8 Signaling | 1,747 | 1,026 | 2,773 | - | - | - | - | - | - | - | - | - | 1,747 | 1,026 | 2,773 | 3,602 | 2,115 | 5,717 |
| Subtotal Category 3 | 14,789 | 1,614 | 16,403 | 6,864 | 593 | 7,457 | 5,910 | 840 | 6,750 | 2,114 | 60 | 2,174 | 29,677 | 3,107 | 32,784 | 61,190 | 6,406 | 67,596 |
| 4 Way and Structures | | | | | | | | | | | | | | | | | | |
| 4.1 Rail renewal, 50 kg rails (200 km) | 1,100 | 3,400 | 4,500 | - | - | - | - | - | - | - | - | - | 1,100 | 3,400 | 4,500 | 2,268 | 7,010 | 9,278 |
| 4.2 Track renewal, 50 kg rails (20 km) | 650 | 340 | 990 | - | - | - | - | - | - | - | - | - | 650 | 340 | 990 | 1,340 | 701 | 2,041 |
| 4.3 Concrete sleepers (50,000) | 675 | - | 675 | - | - | - | - | - | - | - | - | - | 675 | - | 675 | 1,392 | - | 1,392 |
| 4.4 Paints and crossings (500) | 200 | 250 | 450 | - | - | - | - | - | - | - | - | - | 200 | 250 | 450 | 412 | 516 | 928 |
| 4.5 Bridge strengthening (70 spans) | 712 | - | 712 | - | - | - | - | - | - | - | - | - | 712 | - | 712 | 1,468 | - | 1,468 |
| 4.6 Tunnel strengthening | 135 | - | 135 | - | - | - | - | - | - | - | - | - | 135 | - | 135 | 278 | - | 278 |
| 4.7 Level crossings | 1,321 | - | 1,321 | - | - | - | - | - | - | - | - | - | 1,321 | - | 1,321 | 2,724 | - | 2,724 |
| 4.8 Permanent way equipment | 421 | 1,086 | 1,507 | - | - | - | - | - | - | - | - | - | 421 | 1,086 | 1,507 | 868 | 2,239 | 3,107 |
| 4.9 Miscellaneous | 290 | - | 290 | - | - | - | - | - | - | - | - | - | 290 | - | 290 | 598 | - | 598 |
| Subtotal Category 4 | 5,504 | 5,076 | 10,580 | - | - | - | - | - | - | - | - | - | 5,504 | 5,076 | 10,580 | 11,348 | 10,466 | 21,814 |
| 5 Motive Power and Rolling Stock | | | | | | | | | | | | | | | | | | |
| 5.1 New electric locomotives (20) | 898 | 9,206 | 10,104 | - | - | - | - | - | - | - | - | - | 898 | 9,206 | 10,104 | 1,852 | 18,981 | 20,833 |
| 5.2 New electric rail cars (90) | 8,150 | - | 8,150 | 9,021 | - | 9,021 | - | - | - | - | - | - | 17,171 | - | 17,171 | 35,404 | - | 35,404 |
| 5.3 Motive power remodeling/repowering | 1,682 | 4,723 | 6,405 | - | - | - | - | - | - | - | - | - | 1,682 | 4,723 | 6,405 | 3,468 | 9,738 | 13,206 |
| 5.4 New passenger cars (42) | 3,038 | 690 | 3,728 | - | - | - | - | - | - | - | - | - | 3,038 | 690 | 3,728 | 6,264 | 1,423 | 7,687 |
| 5.5 New freight cars (750) | - | 5,819 | 5,819 | - | 3,500 | 3,500 | - | - | - | - | - | - | - | 9,319 | 9,319 | - | 19,214 | 19,214 |
| 5.6 Freight car remodeling (103) | 396 | - | 396 | - | - | - | - | - | - | - | - | - | 396 | - | 396 | 817 | - | 817 |
| Subtotal Category 5 | 14,164 | 20,438 | 34,602 | 9,021 | 3,500 | 12,521 | - | - | - | - | - | - | 23,185 | 23,938 | 47,123 | 47,805 | 49,356 | 97,161 |
| 6 Rolling Stock Repair Facilities | | | | | | | | | | | | | | | | | | |
| 6.1 New Daejeon freight wagon shop | 846 | 1,002 | 1,848 | 2,249 | 1,501 | 3,750 | - | - | - | - | - | - | 3,095 | 2,503 | 5,598 | 6,381 | 5,161 | 11,542 |
| 6.2 Improvement of existing backshops | 50 | - | 50 | - | - | - | - | - | - | - | - | - | 50 | - | 50 | 103 | - | 103 |
| 6.3 Improvement of existing sheds | 273 | 252 | 525 | - | - | - | - | - | - | - | - | - | 273 | 252 | 525 | 563 | 520 | 1,083 |
| Subtotal Category 6 | 1,169 | 1,254 | 2,423 | 2,249 | 1,501 | 3,750 | - | - | - | - | - | - | 3,418 | 2,755 | 6,173 | 7,047 | 5,681 | 12,728 |
| 7 Other Investments | | | | | | | | | | | | | | | | | | |
| 7.1 Telecommunications | 582 | 171 | 753 | - | - | - | - | - | - | - | - | - | 582 | 171 | 753 | 1,200 | 353 | 1,553 |
| 7.2 Power facilities | 110 | - | 110 | - | - | - | - | - | - | - | - | - | 110 | - | 110 | 227 | - | 227 |
| 7.3 Housing facilities | 653 | - | 653 | - | - | - | - | - | - | - | - | - | 653 | - | 653 | 1,346 | - | 1,346 |
| 7.4 Miscellaneous | 3,159 | 613 | 3,772 | 300 | 133 | 433 | - | - | - | - | - | - | 3,459 | 746 | 4,205 | 7,132 | 1,538 | 8,670 |
| Subtotal Category 7 | 4,504 | 784 | 5,288 | 300 | 133 | 433 | - | - | - | - | - | - | 4,804 | 917 | 5,721 | 9,905 | 1,891 | 11,796 |
| Total Categories 1-7 | 41,354 | 29,166 | 70,520 | 19,734 | 5,727 | 25,461 | 5,910 | 840 | 6,750 | 2,114 | 60 | 2,174 | 69,112 | 35,793 | 104,905 | 142,499 | 73,800 | 216,299 |
| 8 Physical contingency (10% except for items 4.1 and 4.2 and Category 5) | 2,544 | 499 | 3,043 | 1,071 | 223 | 1,294 | 591 | 84 | 675 | 212 | 6 | 218 | 4,418 | 812 | 5,230 | 9,109 | 1,674 | 10,783 |
| 9 Price contingency (for local currency items 8% annually in 1977/78, 7.5% in 1979 and 7% in 1980; for foreign currency items 8% annually in 1977, 7% in 1978, 6.5% in 1979 and 6% in 1980) | 1,756 | 1,187 | 2,943 | 2,563 | 702 | 3,265 | 1,367 | 179 | 1,546 | 693 | 18 | 711 | 6,379 | 2,086 | 8,465 | 13,153 | 4,301 | 17,454 |
| GRAND TOTAL | 45,654 | 30,852 | 76,506 | 23,368 | 6,652 | 30,020 | 7,868 | 1,103 | 8,971 | 3,019 | 84 | 3,103 | 79,909 | 38,691 | 118,600 | 164,761 | 79,775 | 244,536 |

Note: US$1.00 = 485 won.

Source: KNR and mission.

KOREA

SIXTH RAILWAY PROJECT

KNR Investment Plan 1977-81, Items Starting in 1980/81

| | 1980 | | | 1981 | | | Total expenditure 1980/81 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total |
| | ---------- Won million ---------- | | | | | | | | | ------- US$'000 ------- | | |
| 1 New Line Construction | | | | | | | | | | | | |
| 1.1 Industrial sidings (2 places) | 3,420 | - | 3,420 | 2,949 | - | 2,949 | 6,369 | - | 6,369 | 13,132 | - | 13,132 |
| Subtotal Category 1 | 3,420 | - | 3,420 | 2,949 | - | 4,949 | 6,369 | - | 6,369 | 13,132 | - | 13,132 |
| 2 Electrification | | | | | | | | | | | | |
| 2.1 Jecheon-Yeongju (64 km) | 1,695 | 1,510 | 3,205 | 1,973 | 1,606 | 3,579 | 3,668 | 3,116 | 6,784 | 7,563 | 6,425 | 13,988 |
| Subtotal Category 2 | 1,695 | 1,510 | 3,205 | 1,973 | 1,606 | 3,579 | 3,668 | 3,116 | 6,784 | 7,563 | 6,425 | 13,988 |
| 3 Increase in Station and Line Capacity | | | | | | | | | | | | |
| 3.1 Double tracking (about 20 km) | 5,280 | 745 | 6,025 | 7,210 | 1,420 | 8,630 | 12,490 | 2,165 | 14,655 | 25,753 | 4,464 | 30,217 |
| 3.2 Bypass lines (1 place) | 600 | - | 600 | 1,216 | 286 | 1,502 | 1,816 | 286 | 2,102 | 3,744 | 590 | 4,334 |
| 3.3 Additional crossing loops (14 places) | 574 | 126 | 700 | 574 | 126 | 700 | 1,148 | 252 | 1,400 | 2,367 | 519 | 2,886 |
| 3.4 Station yard extensions (5 places) | 251 | 64 | 315 | 296 | 60 | 356 | 547 | 124 | 671 | 1,128 | 256 | 1,384 |
| 3.5 Freight handling facilities | 450 | - | 450 | 450 | - | 450 | 900 | - | 900 | 1,855 | - | 1,855 |
| 3.6 Lengthening of crossing loops (11 places) | 616 | 105 | 721 | 352 | 60 | 412 | 968 | 165 | 1,133 | 1,996 | 340 | 2,336 |
| 3.7 Station installations | 774 | - | 774 | 974 | - | 974 | 1,748 | - | 1,748 | 3,604 | - | 3,604 |
| 3.8 Signaling | 2,785 | - | 2,785 | 4,303 | - | 4,303 | 7,088 | - | 7,088 | 14,615 | - | 14,615 |
| 3.9 Busan area improvement | 360 | 30 | 390 | - | - | - | 360 | 30 | 390 | 742 | 62 | 804 |
| Subtotal Category 3 | 11,690 | 1,070 | 12,760 | 15,375 | 1,952 | 17,327 | 27,065 | 3,022 | 30,087 | 55,804 | 6,231 | 62,035 |
| 4 Way and Structures | | | | | | | | | | | | |
| 4.1 Rail renewal, 50 kg rails (180 km) | 440 | 1,360 | 1,800 | 550 | 1,700 | 2,250 | 990 | 3,060 | 4,050 | 2,041 | 6,309 | 8,350 |
| 4.2 Rail renewal, 60 kg rails (30 km) | 165 | 612 | 777 | - | - | - | 165 | 612 | 777 | 340 | 1,262 | 1,602 |
| 4.3 Track renewal, 50 kg rails (50 km) | 650 | 340 | 990 | 975 | 510 | 1,485 | 1,625 | 850 | 2,475 | 3,351 | 1,753 | 5,104 |
| 4.4 Track renewal, 60 kg rails (60 km) | 975 | 612 | 1,587 | 975 | 612 | 1,587 | 1,950 | 1,224 | 3,174 | 4,021 | 2,524 | 6,545 |
| 4.5 Concrete sleepers (200,000) | 1,350 | - | 1,350 | 1,350 | - | 1,350 | 2,700 | - | 2,700 | 5,567 | - | 5,567 |
| 4.6 Points and crossings (480) | 300 | 120 | 420 | 300 | 120 | 420 | 600 | 240 | 840 | 1,237 | 495 | 1,732 |
| 4.7 Bridge strengthening (7 spans) | 30 | - | 30 | - | - | - | 30 | - | 30 | 62 | - | 62 |
| 4.8 Tunnel strengthening | 150 | - | 150 | 200 | - | 200 | 350 | - | 350 | 722 | - | 722 |
| 4.9 Ballast (320,000 cu m) | 640 | - | 640 | 640 | - | 640 | 1,280 | - | 1,280 | 2,639 | - | 2,639 |
| 4.10 Level crossings | 2,660 | - | 2,660 | 2,660 | - | 2,660 | 5,320 | - | 5,320 | 10,969 | - | 10,969 |
| 4.11 Miscellaneous | 210 | - | 210 | 320 | - | 320 | 530 | - | 530 | 1,093 | - | 1,093 |
| Subtotal Category 4 | 7,570 | 3,044 | 10,614 | 7,970 | 2,942 | 10,912 | 15,540 | 5,986 | 21,526 | 32,042 | 12,343 | 44,385 |
| 5 Motive Power and Rolling Stock | | | | | | | | | | | | |
| 5.1 New diesel main line locomotives (12) | 25 | 1,825 | 1,850 | 35 | 2,555 | 2,590 | 60 | 4,380 | 4,440 | 124 | 9,031 | 9,155 |
| 5.2 New diesel shunting locomotives (13) | 30 | 1,020 | 1,050 | 35 | 1,190 | 1,225 | 65 | 2,210 | 2,275 | 134 | 4,556 | 4,690 |
| 5.3 New breakdown cranes (2) | - | - | - | 26 | 700 | 726 | 26 | 700 | 726 | 54 | 1,443 | 1,497 |
| 5.4 Motive power remodeling/repairing (140 units) | 1,745 | 4,500 | 6,245 | 1,168 | 3,840 | 5,008 | 2,913 | 8,340 | 11,253 | 6,006 | 17,196 | 23,202 |
| 5.5 New passenger cars (189) | 1,844 | 9,220 | 11,064 | 1,624 | 8,120 | 9,744 | 3,468 | 17,340 | 20,808 | 7,150 | 35,753 | 42,903 |
| 5.6 Passenger car remodeling (145) | 371 | - | 371 | 403 | - | 403 | 774 | - | 774 | 1,596 | - | 1,596 |
| 5.7 New freight cars (1,100) | - | 7,450 | 7,450 | - | 7,435 | 7,435 | - | 14,885 | 14,885 | - | 30,691 | 30,691 |
| 5.8 Freight car remodeling (1,262) | 2,061 | - | 2,061 | 1,965 | - | 1,965 | 4,026 | - | 4,026 | 8,301 | - | 8,301 |
| Subtotal Category 5 | 6,076 | 24,015 | 30,091 | 5,256 | 23,840 | 29,096 | 11,332 | 47,855 | 59,187 | 23,365 | 98,670 | 122,035 |
| 6 Rolling Stock Repair Facilities | | | | | | | | | | | | |
| 6.1 New Daejeon repair shop | - | - | - | 2,000 | - | 2,000 | 2,000 | - | 2,000 | 4,123 | - | 4,123 |
| 6.2 Improvement of existing backshops | 400 | 500 | 900 | - | - | - | 400 | 500 | 900 | 825 | 1,031 | 1,856 |
| 6.3 Improvement of existing sheds | 472 | 140 | 612 | 335 | 70 | 405 | 807 | 210 | 1,017 | 1,664 | 433 | 2,097 |
| Subtotal Category 6 | 872 | 640 | 1,512 | 2,335 | 70 | 2,405 | 3,207 | 710 | 3,917 | 6,612 | 1,464 | 8,076 |
| 7 Telecommunications, Power Facilities, Buildings and Others | | | | | | | | | | | | |
| 7.1 Telecommunications | 284 | - | 284 | 212 | - | 212 | 496 | - | 496 | 1,023 | - | 1,023 |
| 7.2 Power facilities | 200 | 5 | 205 | 200 | 5 | 205 | 400 | 10 | 410 | 825 | 21 | 846 |
| 7.3 Buildings | - | - | - | 685 | - | 685 | 685 | - | 685 | 1,413 | - | 1,413 |
| 7.4 Housing facilities | 1,365 | - | 1,365 | 1,000 | - | 1,000 | 2,365 | - | 2,365 | 4,876 | - | 4,876 |
| 7.5 Miscellaneous | 1,150 | 150 | 1,300 | 1,150 | 150 | 1,300 | 2,300 | 300 | 2,600 | 4,742 | 618 | 5,360 |
| Subtotal Category 7 | 2,999 | 155 | 3,154 | 3,247 | 155 | 3,402 | 6,246 | 310 | 6,556 | 12,879 | 639 | 13,518 |
| Total Categories 1-7 | 34,322 | 30,434 | 64,756 | 39,105 | 30,565 | 69,670 | 73,427 | 60,999 | 134,426 | 151,397 | 125,772 | 277,169 |
| 8 Physical contingency (10% except for items 4.1-4.4 and Category 5) | 2,602 | 350 | 2,951 | 3,135 | 390 | 3,525 | 5,736 | 740 | 6,476 | 11,828 | 1,525 | 13.353 |
| 9 Price contingency (for local currency items ~~8%~~ annually in 1977/78, 7.5% in 1979 and 7% in 1980/81; for foreign currency items 8% annually in 1977, 7% in 1978, 6.5% in 1979 and 6% in 1980/81) | 10,999 | 8,253 | 19,252 | 16,423 | 10,654 | 27,077 | 27,422 | 18,907 | 46,329 | 56,541 | 38,984 | 95,525 |
| GRAND TOTAL | 47,922 | 39,037 | 86,959 | 58,663 | 41,609 | 100,272 | 106,585 | 80,646 | 187,231 | 219,766 | 166,281 | 386,047 |

Note: US$1.00 = 485 won.

Source: KNR and mission.

KOREA

SIXTH RAILWAY PROJECT

The Project (KNR Investments Starting in 1978-79)

| Item | Line | 1978 | | | 1979 | | | 1980 | | | 1981 | | | Total expenditures 1978-81 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total |
| | | Won million | | | | | | | | | | | | | | | US$'000 | | |
| 1 New Line Construction | | | | | | | | | | | | | | | | | | | |
| 1.1 Coal siding Ogma | | - | - | - | 94 | - | 94 | - | - | - | - | - | - | 94 | - | 94 | 194 | - | 194 |
| 1.2 Siding for Changweon machinery complex | Gyeong Jeon | 1,000 | - | 1,000 | 1,206 | - | 1,206 | - | - | - | - | - | - | 2,206 | - | 2,206 | 4,548 | - | 4,548 |
| Subtotal Category 1 | | 1,000 | - | 1,000 | 1,300 | - | 1,300 | - | - | - | - | - | - | 2,300 | - | 2,300 | 4,742 | - | 4,742 |
| 2 Electrification | | | | | | | | | | | | | | | | | | | |
| 2.1 Seoul-Susaeg (8.5 km) | Gyeong Eui | - | - | - | 800 | 840 | 1,640 | - | - | - | - | - | - | 800 | 840 | 1,640 | 1,650 | 1,732 | 3,382 |
| Subtotal Category 2 | | - | - | - | 800 | 840 | 1,640 | - | - | - | - | - | - | 800 | 840 | 1,640 | 1,650 | 1,732 | 3,382 |
| 3 Increase in Station and Line Capacity | | | | | | | | | | | | | | | | | | | |
| 3.1 Double tracking | | | | | | | | | | | | | | | | | | | |
| 3.1.1 Gongjaon-Bongyang (8.6 km) | Chung Bug | - | - | - | 1,792 | 190 | 1,982 | - | - | - | - | - | - | 1,792 | 190 | 1,982 | 3,695 | 391 | 4,086 |
| 3.1.2 Yongsan-Susaeg (9.6 km) | Yong San | - | - | - | 1,000 | - | 1,000 | 1,584 | 1,035 | 2,619 | - | - | - | 2,584 | 1,035 | 3,619 | 5,328 | 2,134 | 7,462 |
| 3.1.3 Seongbug-Kuijeonbu (13.1 km) | Gyeong Weon | - | - | - | 1,500 | - | 1,500 | 2,063 | 1,454 | 3,517 | - | - | - | 3,563 | 1,454 | 5,017 | 7,347 | 2,998 | 10,345 |
| Subtotal Category 3.1 | | - | - | - | 4,292 | 190 | 4,482 | 3,647 | 2,489 | 6,136 | - | - | - | 7,939 | 2,679 | 10,618 | 16,370 | 5,523 | 21,893 |
| 3.2 Bypass lines | | | | | | | | | | | | | | | | | | | |
| 3.2.1 Gyeongju (3.5 km) | Donghae Nambu | 200 | - | 200 | 552 | 77 | 629 | - | - | - | - | - | - | 752 | 77 | 829 | 1,551 | 159 | 1,710 |
| Subtotal Category 3.2 | | 200 | - | 200 | 552 | 77 | 629 | - | - | - | - | - | - | 752 | 77 | 829 | 1,551 | 159 | 1,710 |
| 3.3 Additional crossing loops | | | | | | | | | | | | | | | | | | | |
| 3.3.1 1 place | Gyeong Bu | 100 | - | 100 | - | - | - | - | - | - | - | - | - | 100 | - | 100 | 206 | - | 206 |
| 3.3.2 3 places | Jung Ang | 164 | 36 | 200 | 82 | 18 | 100 | - | - | - | - | - | - | 246 | 54 | 300 | 507 | 112 | 619 |
| 3.3.3 2 places | Jang Hang | 82 | 18 | 100 | 82 | 18 | 100 | - | - | - | - | - | - | 164 | 36 | 200 | 338 | 74 | 412 |
| 3.3.4 1 place | Dae Gu | 82 | 18 | 100 | - | - | - | - | - | - | - | - | - | 82 | 18 | 100 | 169 | 37 | 206 |
| 3.3.5 1 place | Ho Nam | - | - | - | 82 | 18 | 100 | - | - | - | - | - | - | 82 | 18 | 100 | 169 | 37 | 206 |
| 3.3.6 2 places | Jeon Ra | 82 | 18 | 100 | 82 | 18 | 100 | - | - | - | - | - | - | 164 | 36 | 200 | 338 | 74 | 412 |
| 3.3.7 4 places | Donghae Nambu | 164 | 36 | 200 | 164 | 36 | 200 | - | - | - | - | - | - | 328 | 72 | 400 | 677 | 148 | 825 |
| 3.3.8 3 places | Tae Baeg | 164 | 36 | 200 | 82 | 18 | 100 | - | - | - | - | - | - | 246 | 54 | 300 | 507 | 112 | 617 |
| Subtotal Category 3.3 | | 838 | 162 | 1,000 | 574 | 126 | 700 | - | - | - | - | - | - | 1,412 | 288 | 1,700 | 2,911 | 594 | 3,505 |
| 3.4 Marshalling yard extensions | | | | | | | | | | | | | | | | | | | |
| 3.4.1 Jecheon | Jung Ang | 888 | 72 | 960 | - | - | - | 800 | - | 800 | - | - | - | 1,688 | 72 | 1,760 | 3,481 | 148 | 3,629 |
| 3.4.2 Deogha | Donghae Nambu | 300 | - | 300 | 220 | 80 | 300 | - | - | - | - | - | - | 520 | 80 | 600 | 1,072 | 165 | 1,237 |
| Subtotal Category 3.4 | | 1,188 | 72 | 1,260 | 220 | 80 | 300 | 800 | - | 800 | - | - | - | 2,208 | 152 | 2,360 | 4,553 | 313 | 4,866 |
| 3.5 Station yard extensions | | | | | | | | | | | | | | | | | | | |
| 3.5.1 3 places | Gyeong Bu | 171 | 34 | 205 | 120 | 30 | 150 | - | - | - | - | - | - | 291 | 64 | 355 | 600 | 132 | 732 |
| 3.5.2 1 place | Gyeong Eui | 159 | 12 | 171 | - | - | - | - | - | - | - | - | - | 159 | 12 | 171 | 328 | 25 | 353 |
| 3.5.3 3 places | Jeon Ra | 178 | 36 | 214 | 133 | 27 | 160 | - | - | - | - | - | - | 311 | 63 | 374 | 641 | 130 | 771 |
| Subtotal Category 3.5 | | 508 | 82 | 590 | 253 | 57 | 310 | - | - | - | - | - | - | 761 | 139 | 900 | 1,569 | 287 | 1,856 |
| 3.6 Freight handling facilities | | | | | | | | | | | | | | | | | | | |
| 3.6.1 Freight terminal Bugog | Gyeong Bu | 300 | - | 300 | 500 | - | 500 | 500 | - | 500 | 300 | - | 300 | 1,600 | - | 1,600 | 3,299 | - | 3,299 |
| 3.6.2 Freight terminal West Seoul | Gyeong Eui | - | - | - | 400 | - | 400 | 400 | - | 400 | 400 | - | 400 | 1,200 | - | 1,200 | 2,474 | - | 2,474 |
| Subtotal Category 3.6 | | 300 | - | 300 | 900 | - | 900 | 900 | - | 900 | 700 | - | 700 | 2,800 | - | 2,800 | 5,773 | - | 5,773 |
| 3.7 Lengthening of crossing loops | | | | | | | | | | | | | | | | | | | |
| 3.7.1 3 places | Ho Nam | - | - | - | 264 | 45 | 309 | - | - | - | - | - | - | 264 | 45 | 309 | 544 | 93 | 637 |
| Subtotal Category 3.7 | | - | - | - | 264 | 45 | 309 | - | - | - | - | - | - | 264 | 45 | 309 | 544 | 93 | 637 |
| 3.8 Station installations | | | | | | | | | | | | | | | | | | | |
| 3.8.1 Seoul station yard facilities | Gyeong Bu | 200 | - | 200 | 800 | - | 800 | 900 | - | 900 | - | - | - | 1,900 | - | 1,900 | 3,918 | - | 3,918 |
| 3.8.2 Station buildings (30 places) | | 60 | - | 60 | 60 | - | 60 | - | - | - | - | - | - | 120 | - | 120 | 247 | - | 247 |
| 3.8.3 Underground passages (8 places) | | 200 | - | 200 | 200 | - | 200 | - | - | - | - | - | - | 400 | - | 400 | 825 | - | 825 |
| 3.8.4 Passenger sheds (12 places) | | 180 | - | 180 | 180 | - | 180 | - | - | - | - | - | - | 360 | - | 360 | 742 | - | 742 |
| 3.8.5 Freight sheds (30 places) | | 199 | - | 199 | 198 | - | 198 | - | - | - | - | - | - | 397 | - | 397 | 819 | - | 819 |
| 3.8.6 Automatic ticket machines | | - | 110 | 110 | 110 | - | 110 | - | - | - | - | - | - | 110 | 110 | 220 | 227 | 227 | 454 |
| Subtotal Category 3.8 | | 839 | 110 | 949 | 1,548 | - | 1,548 | 900 | - | 900 | - | - | - | 3,287 | 110 | 3,397 | 6,778 | 227 | 7,005 |
| 3.9 Signaling | | | | | | | | | | | | | | | | | | | |
| 3.9.1 Automatic train stop (19 station signals, 100 sets of cab equipment) | | 226 | - | 226 | 150 | - | 150 | - | - | - | - | - | - | 376 | - | 376 | 775 | - | 775 |
| 3.9.2 CTC Yeongju-Gyeongju (163.5 km) | Jung Ang | - | - | - | 2,100 | - | 2,100 | 2,100 | - | 2,100 | 2,320 | - | 2,320 | 6,520 | - | 6,520 | 13,444 | - | 13,444 |
| 3.9.3 CTE Dongdaegu-Yongcheon (34.9 km) | Dae Gu | - | - | - | 1,200 | - | 1,200 | - | - | - | - | - | - | 1,200 | - | 1,200 | 2,474 | - | 2,474 |
| 3.9.4 Interlocking, Class 2 (9 places) | Ho Nam | 200 | - | 200 | 250 | - | 250 | - | - | - | - | - | - | 450 | - | 450 | 928 | - | 928 |
| 3.9.5 Remote control (2 places) | Ho Nam | 100 | - | 100 | 100 | - | 100 | - | - | - | - | - | - | 200 | - | 200 | 412 | - | 412 |
| 3.9.6 Warning devices at level crossings (350 places) | | 410 | - | 410 | 164 | - | 164 | - | - | - | - | - | - | 574 | - | 574 | 1,184 | - | 1,184 |
| 3.9.7 External signaling (40 places) | | 50 | - | 50 | 50 | - | 50 | - | - | - | - | - | - | 100 | - | 100 | 206 | - | 206 |
| Subtotal Category 3.9 | | 986 | - | 986 | 4,014 | - | 4,014 | 2,100 | - | 2,100 | 2,320 | - | 2,320 | 9,420 | - | 9,420 | 19,423 | - | 19,423 |
| 3.10 *Busan area improvement* | | | | | | | | | | | | | | | | | | | |
| 3.10.1 New track layout | | - | - | - | 200 | - | 200 | 451 | 32 | 483 | - | - | - | 651 | 32 | 683 | 1,342 | 66 | 1,408 |
| Subtotal Category 3.10 | | - | - | - | 200 | - | 200 | 451 | 32 | 483 | - | - | - | 651 | 32 | 683 | 1,342 | 66 | 1,408 |
| Subtotal Category 3 | | 4,859 | 426 | 5,285 | 12,817 | 575 | 13,392 | 8,798 | 2,521 | 11,319 | 3,020 | - | 3,020 | 29,494 | 3,522 | 33,016 | 60,814 | 7,262 | 68,076 |
| 4 Way and Structures | | | | | | | | | | | | | | | | | | | |
| 4.1 Rail renewal, 50 kg rails (260 km) | | 743 | 2,295 | 3,038 | 687 | 2,125 | 2,812 | - | - | - | - | - | - | 1,430 | 4,420 | 5,850 | 2,949 | 9,113 | 12,062 |
| 4.2 Track renewal, 50 kg rails (70 km) | | 975 | 510 | 1,485 | 1,300 | 680 | 1,980 | - | - | - | - | - | - | 2,275 | 1,190 | 3,465 | 4,691 | 2,454 | 7,145 |
| 4.3 Concrete sleepers (150,000) | | 675 | - | 675 | 1,350 | - | 1,350 | - | - | - | - | - | - | 2,025 | - | 2,025 | 4,175 | - | 4,175 |
| 4.4 Points and crossings, renewal work | | 350 | - | 350 | 350 | - | 350 | - | - | - | - | - | - | 700 | - | 700 | 1,443 | - | 1,443 |
| 4.5 Bridge strengthening (93 spans) | | 146 | - | 146 | 226 | - | 226 | - | - | - | - | - | - | 372 | - | 372 | 767 | - | 767 |
| 4.6 Tunnel strengthening | | 250 | - | 250 | 150 | - | 150 | - | - | - | - | - | - | 400 | - | 400 | 825 | - | 825 |
| 4.7 Ballast (320,000 cu m) | | 640 | - | 640 | 640 | - | 640 | - | - | - | - | - | - | 1,280 | - | 1,280 | 2,639 | - | 2,639 |
| 4.8 Separation of rail and road level (59 places) | | 5,070 | - | 5,070 | 2,600 | - | 2,600 | - | - | - | - | - | - | 7,670 | - | 7,670 | 15,815 | - | 15,815 |
| 4.9 Level crossing barriers (40 places) | | 120 | - | 120 | 120 | - | 120 | - | - | - | - | - | - | 240 | - | 240 | 495 | - | 495 |
| 4.10 Track material workshop | | 300 | 595 | 895 | 188 | 474 | 662 | - | - | - | - | - | - | 488 | 1,069 | 1,557 | 1,006 | 2,204 | 3,210 |
| 4.11 Safety sidings (40 places) | | 320 | - | 320 | 320 | - | 320 | - | - | - | - | - | - | 640 | - | 640 | 1,320 | - | 1,320 |
| 4.12 Water supply | | 100 | - | 100 | 80 | - | 80 | - | - | - | - | - | - | 180 | - | 180 | 371 | - | 371 |
| 4.13 Right-of-way improvements | | 1,520 | - | 1,520 | 1,697 | - | 1,697 | - | - | - | - | - | - | 3,217 | - | 3,217 | 6,633 | - | 6,633 |
| 4.14 Track maintenance equipment | | - | 480 | 480 | - | - | - | - | - | - | - | - | - | - | 480 | 480 | - | 990 | 990 |
| Subtotal Category 4 | | 11,209 | 3,880 | 15,089 | 9,708 | 3,279 | 12,987 | - | - | - | - | - | - | 20,917 | 7,159 | 28,076 | 43,129 | 14,761 | 57,890 |

| Item | Line | 1978 | | | 1979 | | | 1980 | | | 1981 | | | Total expenditures 1978-81 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total | Local | Foreign | Total |
| | | Won million | | | | | | | | | | | | | | | US$'000 | | |
| 5 Motive Power and Rolling Stock | | | | | | | | | | | | | | | | | | | |
| 5.1 Motive power | | | | | | | | | | | | | | | | | | | |
| 5.1.1 New diesel main line locomotives (30) | | 100 | 7,300 | 7,400 | 50 | 3,650 | 3,700 | - | - | - | - | - | - | 150 | 10,950 | 11,100 | 309 | 22,578 | 22,887 |
| 5.1.2 New breakdown cranes (2) | | 26 | 700 | 726 | - | - | - | - | - | - | - | - | - | 26 | 700 | 726 | 54 | 1,443 | 1,497 |
| 5.1.3 Diesel locomotives, remodeling (59) | | 1,000 | 6,000 | 7,000 | 475 | 2,850 | 3,325 | - | - | - | - | - | - | 1,475 | 8,850 | 10,325 | 3,041 | 18,248 | 21,289 |
| 5.1.4 Diesel railcars, remodeling (14) | | 196 | 378 | 574 | - | - | - | - | - | - | - | - | - | 196 | 378 | 574 | 404 | 779 | 1,183 |
| 5.1.5 Heating cars, remodeling (40) | | 520 | - | 520 | 520 | - | 520 | - | - | - | - | - | - | 1,040 | - | 1,040 | 2,144 | - | 2,144 |
| 5.1.6 Breakdown cranes, remodeling (3) | | - | - | - | 15 | 39 | 54 | - | - | - | - | - | - | 15 | 39 | 54 | 31 | 81 | 112 |
| Subtotal Category 5.1 | | 1,842 | 14,378 | 16,220 | 1,060 | 6,539 | 7,599 | - | - | - | - | - | - | 2,902 | 20,917 | 23,819 | 5,983 | 43,129 | 49,112 |
| 5.2 Passenger cars | | | | | | | | | | | | | | | | | | | |
| 5.2.1 New special express coaches (34) | | 672 | 3,360 | 4,032 | 280 | 1,400 | 1,680 | - | - | - | - | - | - | 952 | 4,760 | 5,712 | 1,963 | 9,815 | 11,778 |
| 5.2.2 New special express dining cars (6) | | 160 | 800 | 960 | 32 | 160 | 192 | - | - | - | - | - | - | 192 | 960 | 1,152 | 396 | 1,979 | 2,375 |
| 5.2.3 New special express power source cars (5) | | 216 | 1,080 | 1,296 | 54 | 270 | 324 | - | - | - | - | - | - | 270 | 1,350 | 1,620 | 557 | 2,784 | 3,341 |
| 5.2.4 New limited express coaches (145) | | 1,610 | 8,050 | 9,660 | 420 | 2,100 | 2,520 | - | - | - | - | - | - | 2,030 | 10,150 | 12,180 | 4,186 | 20,928 | 25,114 |
| 5.2.5 New limited express dining cars (7) | | 90 | 450 | 540 | 36 | 180 | 216 | - | - | - | - | - | - | 126 | 630 | 756 | 260 | 1,299 | 1,559 |
| 5.2.6 New limited express power source cars (14) | | 368 | 1,840 | 2,208 | 276 | 1,380 | 1,656 | - | - | - | - | - | - | 644 | 3,220 | 3,864 | 1,328 | 6,639 | 7,967 |
| 5.2.7 Remodeling, passenger cars (30) | | 114 | - | 114 | 57 | - | 57 | - | - | - | - | - | - | 171 | - | 171 | 353 | - | 353 |
| 5.2.8 Remodeling, baggage cars (50) | | 100 | - | 100 | 150 | - | 150 | - | - | - | - | - | - | 250 | - | 250 | 515 | - | 515 |
| Subtotal Category 5.2 | | 3,330 | 15,580 | 18,910 | 1,305 | 5,490 | 6,795 | - | - | - | - | - | - | 4,635 | 21,070 | 25,705 | 9,558 | 43,444 | 53,002 |
| 5.3 Freight cars | | | | | | | | | | | | | | | | | | | |
| 5.3.1 New box cars (550) | | - | 3,625 | 3,625 | - | 4,350 | 4,350 | - | - | - | - | - | - | - | 7,975 | 7,975 | - | 16,444 | 16,444 |
| 5.3.2 New gondolas (870) | | - | 5,460 | 5,460 | - | 5,850 | 5,850 | - | - | - | - | - | - | - | 11,310 | 11,310 | - | 23,320 | 23,320 |
| 5.3.3 Remodeling, cabooses (230) | | 195 | - | 195 | 104 | - | 104 | - | - | - | - | - | - | 299 | - | 299 | 617 | - | 617 |
| 5.3.4 Remodeling, container cars (130) | | 84 | - | 84 | 72 | - | 72 | - | - | - | - | - | - | 156 | - | 156 | 321 | - | 321 |
| 5.3.5 Improvement, freight cars (1,000) | | 1,850 | - | 1,850 | 1,850 | - | 1,850 | - | - | - | - | - | - | 3,700 | - | 3,700 | 7,629 | - | 7,629 |
| Subtotal Category 5.3 | | 2,129 | 9,085 | 11,214 | 2,026 | 10,200 | 12,226 | - | - | - | - | - | - | 4,155 | 19,285 | 23,440 | 8,567 | 39,764 | 48,331 |
| Subtotal Category 5 | | 7,301 | 39,043 | 46,344 | 4,391 | 22,229 | 26,620 | - | - | - | - | - | - | 11,692 | 61,272 | 72,964 | 24,108 | 126,337 | 150,445 |
| 6 Rolling Stock Repair Facilities | | | | | | | | | | | | | | | | | | | |
| 6.1 New Daejeon passenger car shop | Gyeong Bu | - | - | - | 2,000 | - | 2,000 | 2,000 | 1,700 | 3,700 | 2,000 | 800 | 2,800 | 6,000 | 2,500 | 8,500 | 12,371 | 5,155 | 17,526 |
| Subtotal Category 6.1 | | - | - | - | 2,000 | - | 2,000 | 2,000 | 1,700 | 3,700 | 2,000 | 800 | 2,800 | 6,000 | 2,500 | 8,500 | 12,371 | 5,155 | 17,526 |
| 6.2 Improvement of existing backshops | | | | | | | | | | | | | | | | | | | |
| 6.2.1 Seoul | Gyeong Bu | 250 | 1,150 | 1,400 | - | - | - | - | - | - | - | - | - | 250 | 1,150 | 1,400 | 515 | 2,371 | 2,886 |
| 6.2.2 Busan | Gyeong Bu | - | - | - | 550 | 600 | 1,150 | - | - | - | - | - | - | 550 | 600 | 1,150 | 1,134 | 1,237 | 2,371 |
| 6.2.3 Incheon | Gyeong In | 60 | 300 | 360 | - | - | - | - | - | - | - | - | - | 60 | 300 | 360 | 124 | 619 | 743 |
| Subtotal Category 6.2 | | 310 | 1,450 | 1,760 | 550 | 600 | 1,150 | - | - | - | - | - | - | 860 | 2,050 | 2,910 | 1,773 | 4,227 | 6,000 |
| 6.3 Improvement of existing sheds | | | | | | | | | | | | | | | | | | | |
| 6.3.1 Locomotive repair facilities | | 510 | 70 | 580 | 740 | 280 | 1,020 | - | - | - | - | - | - | 1,250 | 350 | 1,600 | 2,577 | 722 | 3,299 |
| 6.3.2 Electric railcar repair facilities | | - | - | - | 200 | - | 200 | - | - | - | - | - | - | 200 | - | 200 | 412 | - | 412 |
| 6.3.3 Car repair facilities | | 300 | 200 | 500 | 450 | 300 | 750 | - | - | - | - | - | - | 750 | 500 | 1,250 | 1,547 | 1,030 | 2,577 |
| Subtotal Category 6.3 | | 810 | 270 | 1,080 | 1,390 | 580 | 1,970 | - | - | - | - | - | - | 2,200 | 850 | 3,050 | 4,536 | 1,752 | 6,288 |
| Subtotal Category 6 | | 1,120 | 1,720 | 2,840 | 3,940 | 1,180 | 5,120 | 2,000 | 1,700 | 3,700 | 2,000 | 800 | 2,800 | 9,060 | 5,400 | 14,460 | 18,680 | 11,134 | 29,814 |
| 7 Telecommunications, Power Facilities, Buildings and Others | | | | | | | | | | | | | | | | | | | |
| 7.1 Telecommunications | | | | | | | | | | | | | | | | | | | |
| 7.1.1 Telecommunication line (90 km) | | 250 | - | 250 | 200 | - | 200 | - | - | - | - | - | - | 450 | - | 450 | 928 | - | 928 |
| 7.1.2 Train radio equipment | | 312 | - | 312 | 196 | - | 196 | - | - | - | - | - | - | 508 | - | 508 | 1,047 | - | 1,047 |
| 7.1.3 Dispatcher telephones | | 63 | - | 63 | 63 | - | 63 | - | - | - | - | - | - | 126 | - | 126 | 260 | - | 260 |
| Subtotal Category 7.1 | | 625 | - | 625 | 459 | - | 459 | - | - | - | - | - | - | 1,084 | - | 1,084 | 2,235 | - | 2,235 |
| 7.2 Power facilities | | | | | | | | | | | | | | | | | | | |
| 7.2.1 Power receiving facilities (10 places) | | 30 | - | 30 | 30 | - | 30 | - | - | - | - | - | - | 60 | - | 60 | 124 | - | 124 |
| 7.2.2 Lighting facilities (30 places) | | 30 | - | 30 | 30 | - | 30 | - | - | - | - | - | - | 60 | - | 60 | 124 | - | 124 |
| 7.2.3 Power line for emergency (50 km) | Jung Ang | 420 | 35 | 455 | 180 | 15 | 195 | - | - | - | - | - | - | 600 | 50 | 650 | 1,237 | 103 | 1,340 |
| 7.2.4 Pole improvements (400 km) | | 80 | - | 80 | 80 | - | 80 | - | - | - | - | - | - | 160 | - | 160 | 330 | - | 330 |
| Subtotal Category 7.2 | | 560 | 35 | 595 | 320 | 15 | 325 | - | - | - | - | - | - | 880 | 50 | 930 | 1,815 | 103 | 1,918 |
| 7.3 Buildings | | | | | | | | | | | | | | | | | | | |
| 7.3.1 Relocation of Technical Research Institute | | 130 | - | 130 | 560 | - | 560 | - | - | - | - | - | - | 690 | - | 690 | 1,423 | - | 1,423 |
| 7.3.2 Central supply office | | 380 | - | 380 | - | - | - | - | - | - | - | - | - | 380 | - | 380 | 783 | - | 783 |
| Subtotal Category 7.3 | | 510 | - | 510 | 560 | - | 560 | - | - | - | - | - | - | 1,070 | - | 1,070 | 2,206 | - | 2,206 |
| 7.4 Housing facilities | | | | | | | | | | | | | | | | | | | |
| 7.4.1 Housing for employees | | 690 | - | 690 | 336 | - | 336 | - | - | - | - | - | - | 1,026 | - | 1,026 | 2,116 | - | 2,116 |
| 7.4.2 Lodging for train crews | | 190 | - | 190 | 106 | - | 106 | - | - | - | - | - | - | 296 | - | 296 | 610 | - | 610 |
| Subtotal Category 7.4 | | 880 | - | 880 | 442 | - | 442 | - | - | - | - | - | - | 1,332 | - | 1,332 | 2,726 | - | 2,726 |
| 7.5 Miscellaneous | | | | | | | | | | | | | | | | | | | |
| 7.5.1 Training and technical assistance | | 50 | 150 | 200 | 50 | 150 | 200 | - | - | - | - | - | - | 100 | 300 | 400 | 206 | 619 | 825 |
| 7.5.2 Procurement of land and property | | 100 | - | 100 | 100 | - | 100 | - | - | - | - | - | - | 200 | - | 200 | 412 | - | 412 |
| 7.5.3 Investment administration | | 1,000 | - | 1,000 | 1,000 | - | 1,000 | - | - | - | - | - | - | 2,000 | - | 2,000 | 4,124 | - | 4,124 |
| Subtotal Category 7.5 | | 1,150 | 150 | 1,300 | 1,150 | 150 | 1,300 | - | - | - | - | - | - | 2,300 | 300 | 2,600 | 4,742 | 619 | 5,361 |
| Subtotal Category 7 | | 3,725 | 185 | 3,910 | 2,931 | 165 | 3,096 | - | - | - | - | - | - | 6,656 | 350 | 7,006 | 13,724 | 722 | 14,446 |
| Total Categories 1~7 | | 29,214 | 45,254 | 74,468 | 35,887 | 28,268 | 64,155 | 10,798 | 4,221 | 15,019 | 5,020 | 800 | 5,820 | 80,919 | 78,543 | 159,462 | 166,847 | 161,948 | 328,795 |
| 8 Physical contingency (10% except for items 4.1, 4.2, 4.10, 4.14 and Category 5) | | 1,990 | 233 | 2,223 | 2,932 | 276 | 3,208 | 1,080 | 422 | 1,502 | 502 | 80 | 582 | 6,504 | 1,011 | 7,515 | 13,411 | 2,084 | 15,495 |
| 9 Price contingency (for local currency items 8% annually in 1977/78, 7.5% in 1979 and 7% in 1980/81; for foreign currency items 8% annually in 1977, 7% in 1978, 6.5% in 1979 and 6% in 1980/81) | | 3,844 | 5,367 | 9,211 | 8,160 | 5,523 | 13,683 | 3,538 | 1,245 | 4,783 | 2,147 | 303 | 2,450 | 17,689 | 12,438 | 30,127 | 36,473 | 25,646 | 62,119 |
| GRAND TOTAL | | 35,048 | 50,854 | 85,902 | 46,979 | 34,067 | 81,046 | 15,416 | 5,888 | 21,304 | 7,669 | 1,183 | 8,852 | 105,112 | 91,992 | 197,104 | 216,731 | 189,678 | 406,409 |

Note: US$1.00 = 485 won.

Table 3.5

KOREA

SIXTH RAILWAY PROJECT

Loan Financed Items

| | Unit | Quantity | Unit Cost (US$) | Total Cost (US$ million) |
|---|---|---|---|---|
| Rails 50 kg/m | tons | 33,000 | 350 | 11.57 |
| Track material workshop machinery | | | | 2.20 |
| Track maintenance equipment | | | | 0.99 |
| Breakdown cranes | no | 2 | 720,000 | 1.44 |
| Passenger cars: | | | | |
| Special express coaches | no | 34 | 290,000 | 9.82 |
| Special express dining cars | no | 6 | 380,000 | 1.98 |
| Special express power source cars | no | 5 | 560,000 | 2.78 |
| Limited express coaches | no | 145 | 145,000 | 20.93 |
| Limited express dining cars | no | 7 | 185,000 | 1.30 |
| Limited express power source cars | no | 14 | 475,000 | 6.64 |
| Freight cars: | | | | |
| Box cars | no | 550 | 30,000 | 16.44 |
| Gondolas | no | 870 | 27,000 | 23.32 |
| Rolling stock workshop equipment | | | | 3.31 |
| Training and technical assistance | | | | 0.62 |
| Subtotal | | | | 103.34 |
| Contingencies | | | | 16.16 |
| Transport sector studies | | | | 0.50 |
| Total | | | | 120.00 |

KOREA

SIXTH RAILWAY PROJECT

KNR Rail Renewal Program, 1977-81

| Line | 1977 | 1978 | 1979 | 1980 | 1981 | Total 1977-81 |
|---|---|---|---|---|---|---|
| | Track km | | | | | |
| Gyeong Bu | 17 | 17 | 16 | 15 | 20 | 85 |
| Jung Ang | 25 | 30 | 25 | 30 /a | - | 110 |
| Gyeong In | - | - | 15 | - | - | 15 |
| Chung Bug | 20 | 20 | - | - | - | 40 |
| Gyeong Bug | - | - | - | 20 | 20 | 40 |
| Dae Gu | 25 | - | - | - | - | 25 |
| Gyeong Weon | - | - | - | 20 | 20 | 40 |
| Gyeong Jeon | 14 | - | - | - | 21 | 35 |
| Ho Nam | 10 | - | - | - | - | 10 |
| Jeon Ra | 35 | - | - | - | - | 35 |
| Donghae Nambu | - | 20 | 25 | - | - | 45 |
| Tae Baeg | 15 | 20 | 15 | - | - | 50 |
| Yeong Dong | 39 | 28 | 29 | 25 | 19 | 140 |
| Total | 200 | 135 | 125 | 110 | 100 | 670 |

/a 60 kg rails.

Source: KNR and mission.

KOREA

SIXTH RAILWAY PROJECT

KNR Track Renewal Program, 1977-81

| Line | 1977 | 1978 | 1979 | 1980 | 1981 | Total 1977-81 |
|---|---|---|---|---|---|---|
| | Track km | | | | | |
| Gyeong Bu | - | 10 | 20 | 20 | 30 | 80 |
| Jung Ang | - | 10 | 20 | 30 /a | 30 /a | 90 |
| Gyeong In | 8 | - | - | - | - | 8 |
| Ho Nam | 4 | - | - | - | - | 4 |
| Donghae Nambu | 8 | 10 | - | - | - | 18 |
| Total | 20 | 30 | 40 | 50 | 60 | 200 |

/a 60 kg rails.

Source: KNR and mission.

KOREA

SIXTH RAILWAY PROJECT

KNR Track Material Workshop: Machinery and Equipment Requirements

| Item | Quantity | Estimated Cost (US$) |
|---|---|---|
| Rail Reprofiling Plant | | |
| Multipurpose loader | 1 | 264,000 |
| Fourway straightening press | 1 | 130,000 |
| Road reprofiling machine | 1 | 520,000 |
| Friction rail saw | 5 | 10,000 |
| Rotating brush | 1 | 3,000 |
| Ultrasonic testing machine | 1 | 20,000 |
| Gantry crane | 1 | 100,000 |
| Roller gangway | 1 | 180,000 |
| Subtotal | | 1,227,000 |
| Switch Point Factory | | |
| Two-head planer | 1 | 200,000 |
| Rail bending machine | 2 | 40,000 |
| Heat treating machine | 1 | 150,000 |
| Friction rail saw | 2 | 4,000 |
| Universal drilling machine | 1 | 40,000 |
| Subtotal | | 434,000 |
| Sleeper Reconditioning Factory | | |
| Sleeper banding machine | 1 | 200,000 |
| Sleeper adzing and drilling machine | 1 | 200,000 |
| Gang trolley | 1 | 20,000 |
| Subtotal | | 420,000 |
| Rail Welding Plant | | |
| Gas welding machine | 1 | 50,000 |
| Driving and pressing set | 1 | 15,000 |
| Grinding machine | 1 | 10,000 |
| Friction rail saw | 2 | 4,000 |
| Rail end brushing machine | 1 | 25,000 |
| Rail drill | 1 | 20,000 |
| Subtotal | | 124,000 |
| Total | | 2,205,000 |

Source: KNR.

**KOREA**

**SIXTH RAILWAY PROJECT**

**Financing of Foreign Currency Part of the Project**

| | | 1978 | 1979 | 1980 | 1981 | Total | IBRD | OECF /a | 50-Cycle /b Group | U.S. EXIM Bank | Suppliers credit | K.F.X./c |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | US$ '000 | | | | | | | | | | |
| 2. | Electrification | | 1,732 | | | 1,732 | | | 1,732 | | | |
| 3.1.2 | Double track Gongjeon-Bongyang (rails, 1,120 tons) | | 391 | | | 391 | | 391 | | | | |
| 3.1.3 | Double track Yongsan-Susaeg | | | | | | | | | | | |
| | (a) Rails, 680 tons | | | 237 | | 237 | | 237 | | | | |
| | (b) Electrification | | | 1,897 | | 1,897 | | | 1,897 | | | |
| 3.1.4 | Double track Seongbug-Euijeonbu | | | | | | | | | | | |
| | (a) Rails, 920 tons | | | 324 | | 324 | | 324 | | | | |
| | (b) Electrification | | | 2,674 | | 2,674 | | | 2,674 | | | |
| 3.2 | By-pass lines (rails, 450 tons) | | 159 | | | 159 | | 159 | | | | |
| 3.3 | Additional crossing loops (rails, 1,700 tons) | 334 | 260 | | | 594 | | 594 | | | | |
| 3.4 | Marshalling yard extensions (rails, 890 tons) | 148 | 165 | | | 313 | | 313 | | | | |
| 3.5 | Station yard extensions (rails, 820 tons) | 169 | 118 | | | 287 | | 287 | | | | |
| 3.7 | Lengthening of crossing loops (rails, 260 tons) | | 93 | | | 93 | | 93 | | | | |
| 3.8.6 | Automatic ticketing machines | 227 | | | | 227 | | | | | 227 | |
| 3.10 | Busan area improvement (rails, 190 tons) | | | 66 | | 66 | | 66 | | | | |
| 4.1 | Rail renewal, 260 km (26,000 tons) | 4,732 | 4,381 | | | 9,113 | 9,113 | | | | | |
| 4.2 | Track renewal, 70 km (7,000 tons) | 1,052 | 1,402 | | | 2,454 | 2,454 | | | | | |
| 4.11 | Track material workshop machinery | 1,227 | 977 | | | 2,204 | 2,204 | | | | | |
| 4.14 | Track maintenance equipment | 990 | | | | 990 | 990 | | | | | |
| 5.1.1 | New diesel main line locomotives (30) | 15,052 | 7,526 | | | 22,578 | | | | 19,191 | | 3,387 |
| 5.1.2 | New breakdown cranes (2) | 1,443 | | | | 1,443 | 1,443 | | | | | |
| 5.1.3 | Diesel locomotives, remodeling (59) | 12,372 | 5,876 | | | 18,248 | | | | 15,511 | | 2,737 |
| 5.1.4 | Diesel railcars, remodeling (14) | 779 | | | | 779 | | | | | | 779 |
| 5.1.6 | Breakdown cranes, remodeling (3) | | 81 | | | 81 | | | | | 81 | |
| 5.2 | New passenger cars (211) | 32,124 | 11,320 | | | 43,444 | 43,444 | | | | | |
| 5.3 | New freight cars (1,420) | 18,732 | 21,032 | | | 39,764 | 39,764 | | | | | |
| 6. | Rolling stock repair facilities (workshop equipment) | 3,546 | 2,433 | 3,505 | 1,650 | 11,134 | 3,310 | | | | 7,824 | |
| 7.2.3 | Power line for emergency | 72 | 31 | | | 103 | | | | | 103 | |
| 7.5.1 | Training and technical assistance | 310 | 309 | | | 619 | 619 | | | | | |
| | Total | 93,309 | 58,286 | 8,703 | 1,650 | 161,948 | 103,341 | 2,464 | 6,303 | 34,702 | 8,235 | 6,903 |
| | Physical contingencies | 480 | 563 | 870 | 165 | 2,084 | 393 | 246 | 630 | - | 815 | |
| | Price contingencies | 11,066 | 11,388 | 2,567 | 625 | 25,646 | 15,766 | 523 | 1,717 | 4,953 | 1,720 | 967 |
| | Grand Total | 104,855 | 70,243 | 12,140 | 2,440 | 189,678 | 119,500 | 3,233 | 8,650 | 39,655 | 10,770 | 7,870 |

/a Overseas Economic Cooperation Fund, Japan.

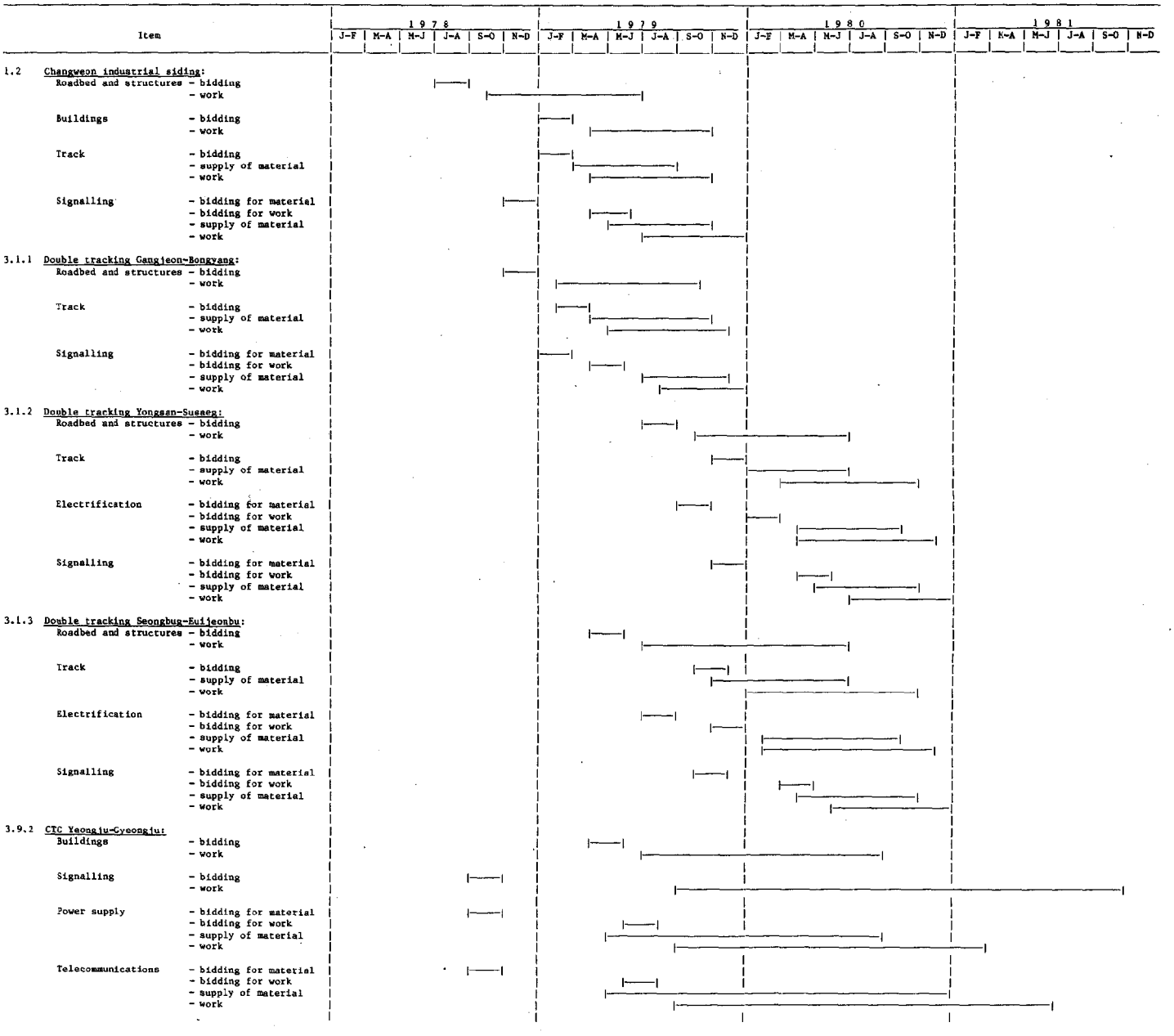
/b European Consortium (for electrification).

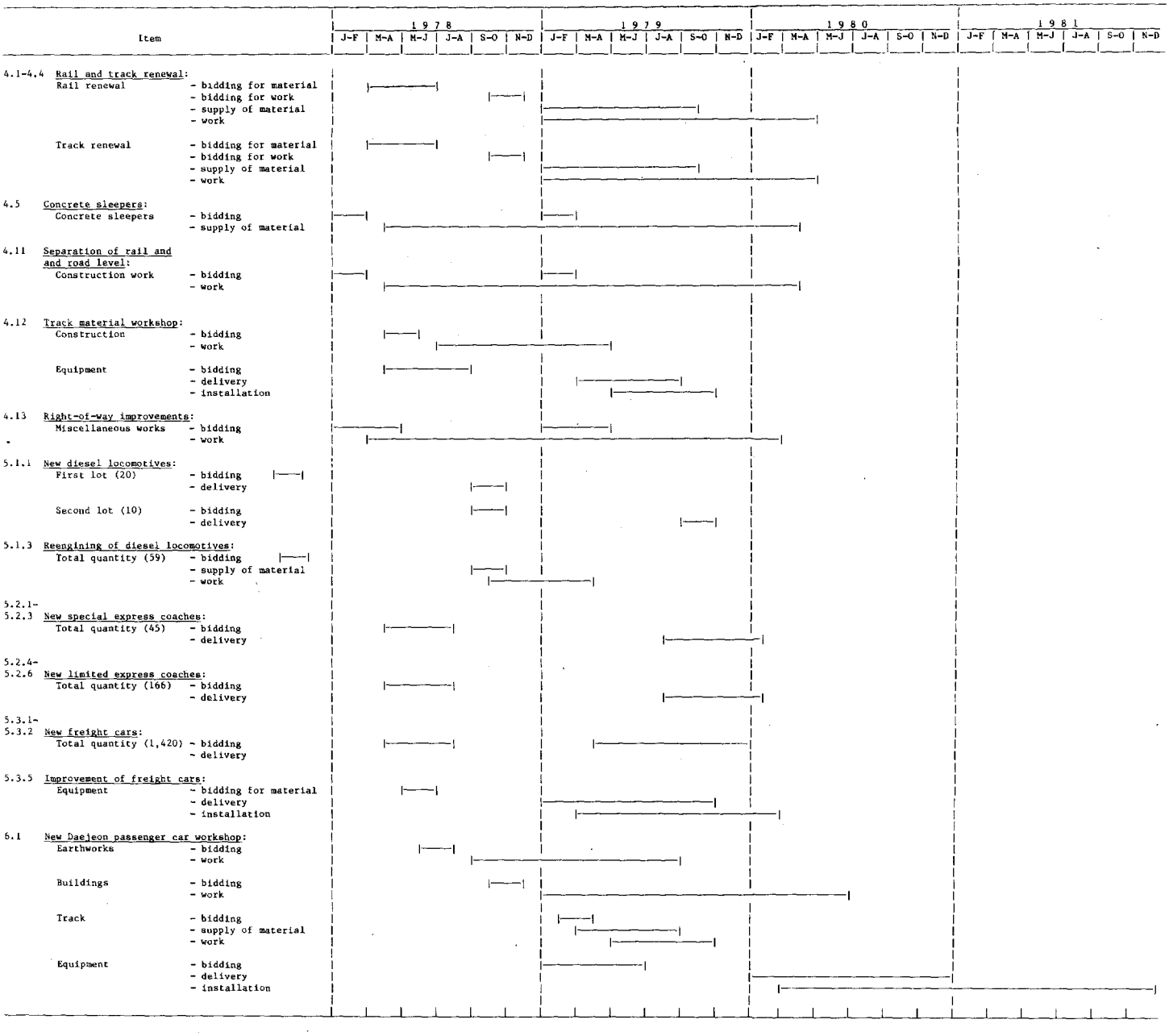
/c Korean Foreign Exchange - purchased by KNR (not debt).

KOREA

SIXTH RAILWAY PROJECT

Project Execution Schedule




Item
1978
1979
1980
1981
J-F
M-A
M-J
J-A
S-O
N-D
4.1-4.4 Rail and track renewal:
Rail renewal
- bidding for material
- bidding for work
- supply of material
- work
Track renewal
- bidding for material
- bidding for work
- supply of material
- work
4.5 Concrete sleepers:
Concrete sleepers
- bidding
- supply of material
4.11 Separation of rail and and road level:
Construction work
- bidding
- work
4.12 Track material workshop:
Construction
- bidding
- work
Equipment
- bidding
- delivery
- installation
4.13 Right-of-way improvements:
Miscellaneous works
- bidding
- work
5.1.1 New diesel locomotives:
First lot (20)
- bidding
- delivery
Second lot (10)
- bidding
- delivery
5.1.3 Reengining of diesel locomotives:
Total quantity (59)
- bidding
- supply of material
- work
5.2.1-5.2.3 New special express coaches:
Total quantity (45)
- bidding
- delivery
5.2.4-5.2.6 New limited express coaches:
Total quantity (166)
- bidding
- delivery
5.3.1-5.3.2 New freight cars:
Total quantity (1,420)
- bidding
- delivery
5.3.5 Improvement of freight cars:
Equipment
- bidding for material
- delivery
- installation
6.1 New Daejeon passenger car workshop:
Earthworks
- bidding
- work
Buildings
- bidding
- work
Track
- bidding
- supply of material
- work
Equipment
- bidding
- delivery
- installation

KOREA

SIXTH RAILWAY PROJECT

Procurement Schedule for Bank Financed Items

| | Events | | | | | | |
|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII |
| Rails (33,000 tons) | 03/01/78 | 03/15/78 | 05/15/78 | 06/15/78 | 07/01/78 | 01/01/79 | 10/01/79 |
| Permanent way workshop machinery | 04/01/78 | 04/15/78 | 07/15/78 | 08/15/78 | 09/01/78 | 03/01/79 | 09/01/79 |
| Track maintenance equipment | 03/01/78 | 03/15/78 | 05/15/78 | 06/15/78 | 07/01/78 | 01/01/79 | 06/01/79 |
| Breakdown cranes (2) | 03/15/78 | 04/01/78 | 06/15/78 | 07/15/78 | 08/01/78 | 06/01/79 | 07/01/79 |
| Passenger cars: | | | | | | | |
| Special express cars (45) | 03/15/78 | 04/01/78 | 06/15/78 | 07/15/78 | 08/01/78 | 08/01/79 | 02/01/80 |
| Limited express cars (166) | 03/15/78 | 04/01/78 | 06/15/78 | 07/15/78 | 08/01/78 | 08/01/79 | 02/01/80 |
| Freight cars (1,420) | 03/15/78 | 04/01/78 | 06/15/78 | 07/15/78 | 08/01/78 | 04/01/79 | 04/01/80 |
| Rolling stock workshop equipment | 01/15/79 | 02/01/79 | 05/15/79 | 06/15/79 | 07/01/79 | 01/01/80 | 01/01/81 |

Events
I. Bank's comments on tender documents
II. Bid invitation
III. Bid opening
IV. Bank's agreement to award of contract
V. Contract date
VI. Start of delivery
VII. Completion of delivery

February 1978

Table 3.12

KOREA

SIXTH RAILWAY PROJECT

Estimated Disbursement Schedule

| | US$ million | |
|---|---|---|
| | Quarter | Cumulative |
| IBRD Fiscal Year and Quarter: | | |
| 1978/79 | | |
| To September 30, 1978 | 11.0 | 11.0 |
| To December 31, 1978 | 5.0 | 16.0 |
| To March 31, 1979 | 15.0 | 31.0 |
| To June 30, 1979 | 16.0 | 47.0 |
| 1979/80 | | |
| To September 30, 1979 | 18.0 | 65.0 |
| To December 31, 1979 | 18.0 | 83.0 |
| To March 31, 1980 | 17.0 | 100.0 |
| To June 30, 1980 | 11.0 | 111.0 |
| 1980/81 | | |
| To September 30, 1980 | 3.0 | 114.0 |
| To December 31, 1980 | 3.0 | 117.0 |
| To March 31, 1981 | 3.0 | 120.0 |

Principal assumptions:

1. Effective date of loan not later than June 15, 1978.

2. Bid invitation for rails and rolling stock not later than April 15, 1978.

Table 4.1

KOREA

SIXTH RAILWAY PROJECT

Grouping of Project Capital Costs for Economic Analysis

| | Million won | Percent |
|---|---|---|
| Capacity increases /a | | |
| Lines | 23,697 | 14.9 |
| Motive power | 23,819 | 14.9 |
| Rolling stock - passenger | 25,705 | 16.1 |
| " " freight | 23,440 | 14.7 |
| Telecommunications and power | 2,014 | 1.3 |
| Subtotal | 98,675 | 61.9 |
| Way and structures renewals | 16,129 | 10.1 |
| Seoul urban network (SMESRS) | 10,276 | 6.5 |
| Daejon passenger car shed | 8,500 | 5.3 |
| Miscellaneous | | |
| Safety related investments (including rail/road crossings and safety sidings) | 8,550 | |
| Line relocation part of larger industrial development projects | 2,983 | |
| Workshop improvements | 5,960 | |
| Miscellaneous including right-of-way improvements, buildings, housing etc. | 8,389 | |
| Subtotal | 25,882 | 16.2 |
| Total /b | 159,462 | 100.0 |

/a See detailed allocation to passenger and freight services on Table 4.2.

/b Excluding contingencies.

Table 4.2

KOREA

SIXTH RAILWAY PROJECT

Allocation of Project Capital Costs of Capacity Increases
Between Passenger and Freight Services
(In million won)

| | Passenger | | | Freight | | |
|---|---|---|---|---|---|---|
| | 1978 | 1979 | 1980-81 | 1978 | 1979 | 1980-81 |
| 1. Lines | | | | | | |
| By-pass lines | 100 | 315 | | 100 | 314 | |
| New loops | 500 | 850 | | 500 | 1,832 | |
| Marshalling yards | - | - | | 1,260 | 300 | 800 |
| Station, yards etc. | - | - | | 590 | 310 | |
| Freight terminals | - | - | | 300 | 900 | 1,600 |
| Length loops | - | 155 | | - | 154 | |
| Station buildings | 649 | 948 | 450 | 300 | 600 | 450 |
| Signalling /a | 390 | 1,600 | 1,770 | 596 | 2,414 | 2,650 |
| Subtotal | 1,639 | 3,868 | 2,220 | 3,646 | 6,824 | 5,500 |
| 2. Motive Power and Rolling Stock /b | | | | | | |
| New locos | 820 | 410 | | 6,580 | 3,290 | |
| Remodelled locos | 3,360 | 1,560 | | 3,640 | 1,765 | |
| Remodelled rail cars and heating cars | 1,094 | 520 | | - | - | |
| Breakdown cranes | 350 | 24 | | 376 | 30 | |
| Cars (passenger and freight | 18,910 | 6,795 | | 11,214 | 12,226 | |
| Subtotal | 24,534 | 9,309 | | 21,810 | 17,311 | |
| 3. Telecommunications and power /c | 700 | 453 | | 520 | 341 | |
| Totals by Year | 28,873 | 13,630 | 2,220 | 25,976 | 24,476 | 5,500 |
| Total Project | | | 98,675 (from Table 4.1) | | | |
| + 10% physical contingencies on 1 and 3 | 234 | 432 | 220 | 417 | 717 | 550 |
| For rate of return calculation (rounded) | 27,100 | 14,100 | 2,400 | 26,400 | 25,200 | 6,100 |

/a Proportional to the number of trains/day for passenger and freight services.
/b According to the locos needed for passenger and freight services.
/c Proportional to train-km for passenger and freight services.

KOREA

SIXTH RAILWAY PROJECT

Comparative Freight Transport Costs by Alternative Modes

i) Revenues and Costs of Rail Transport

| | Revenues | | | Costs | | | Difference | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1974 | 1975 | 1976 | 1974 | 1975 | 1976 | 1974 | 1975 | 1976 |
| | in won/ton-km | | | | | | | | |
| Coal | 2.02 | 2.76 | 3.87 | 2.89 | 3.48 | 5.12 | -0.87 | -0.72 | -1.25 |
| Cement | 2.65 | 4.03 | 5.44 | 3.02 | 4.16 | 5.16 | -0.37 | -0.13 | +0.28 |
| All freight | 2.31 | 3.34 | 4.64 | 4.72 | 5.64 | 5.76 | -2.41 | -2.30 | -1.12 |

Costs include apportioned station, train operating, fixed facilities maintenance, rolling stock maintenance, administration and management, and depreciation costs.

Source: KNR

ii) Road Transport

| | Truck 6t | Truck 12t | Won/ton-km /a | |
|---|---|---|---|---|
| | won/km | | | |
| Operating costs: | | | | |
| (end 1976) economic | 206 | 241 | 45.7 | 26.8 |
| financial | 221 | 272 | 49.1 | 30.2 |
| Tariffs | | | | |
| one way (return empty) per ton-km | | | | 41.6 |
| round trip " | | | | 26.7 |

/a Assumes operation at 75% of capacity

Source: MOT

iii) Coastal Shipping

| | Won per ton |
|---|---|
| Tariffs (1976) | |
| Mukho-Incheon (1,000 km vs 300 km overland) | 2,079-2,621 |
| Busan-Incheon (700 km vs 450 km overland) | 1,769-2,166 |

Source: MOT

iv) Modal Comparison

For the purpose of this analysis the modal comparison is for bulk commodities such as coal, cement, ore and fertilizer since no further capacity is provided by the project for general cargo or bulk oil. The figures above show that the line haul cost of road transport is much higher than that of either rail or coastal shipping. The traffic forecasts given in Part II already reflect the share of coastal shipping when it is competitive i.e. for cement plants, fertilizer plants, oil refineries located on or near the coast. For the remaining traffic for which rail capacity is provided by the project, coastal shipping is no longer a valid alternative as it would require long terminal transport at either end, which would require either rail capacity or a very high cost road transport.

Rail Versus Road Costs. Assuming average rail transport distance of 165 km; this is the average for cement. Average distances for coal and ore are larger and would give even a further advantage to rail:

| | Rail cost | Road cost |
|---|---|---|
| Line haul cost, 165 km | @ W 5.2/t = W 858 | @ W 26.8/t = W 4,422 |
| Terminal costs /a | W 1,000 | - |
| Total | W 1,858 | W 4,422 |
| Per ton-km | 11.3 | 26.8 |
| Difference | W 15.5/ton-km | |

/a Estimated on the basis of 1970 cost analysis by consultants Touche Ross. Including loading, unloading and transportation costs from station within a 5 km radius, the terminal costs were then estimated at W 434/ton. At the factory end, costs are identical since all plants have sidings and direct loading of either rail or road.

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SIXTH RAILWAY PROJECT

Economic Return on Capacity Increase for Freight Services

| | Capital costs /a (W million) | Traffic that would divert to other modes without project /b (in million ton-km) | Economic cost savings from alternative mode /c (W million) |
|---|---|---|---|
| 1978 | 26,400 | 500 | 7,500 |
| 1979 | 25,200 | 1,100 | 16,500 |
| 1980 | 4,000 | 1,100 | 16,500 |
| 1981 | 2,100 | 1,100 | 16,500 |
| 1982-2003 | - | 1,100 | 16,500 |
| | | | Rate of return is 42% |

/a Include investment in - freight wagons
- locomotives (on the basis of diesel loco-km for freight trains)
- line capacity increases and telecommunications equipment allocated to freight services (see detailed allocation of costs in Table 4.2).

/b This is taken conservatively as the capacity generated by the box and gondola cars acquired under the project, assuming improved utilization. The figures above represent somewhat less than 2/3 of the freight traffic increase forecast for 1978 and 1979, and only about 85% of the traffic increase in bulk commodities except oil. The remaining traffic will be handled by improvement in use of the existing stock, including remodelling. Remodelling costs are included in /a above although no specific benefits have been quantified.

/c Difference between transport costs by rail and the least costly alternative. This is generally trucking since coastal shipping is only competitive for traffic with origin and destinations at or near ports and this has already been taken into consideration when forecasting railway traffic. An average of W 15/ton-km is assumed as the cost difference (Table 4.3).

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SIXTH RAILWAY PROJECT

Comparative Passenger Transport Costs by Alternative Modes

(i) Revenues and Costs of the Special and Limited Express Trains

| | Revenues | | Costs | | Difference | |
|---|---|---|---|---|---|---|
| | 1976 | 1977 | 1976 | 1977 /a | 1976 | 1977 |
| | in won/pass-km | | | | | |
| Special express | 8.70 | 9.55 | 4.17 | 5.00 | 4.53 | 4.55 |
| Limited express: | | | | | | |
| nonair-conditioned | 5.17 | 4.87 | 2.83 | 3.40 | 2.34 | 1.47 |
| air-conditioned | - | 7.23 | - | 4.20 | - | 3.03 |

/a Estimates.

Costs include apportioned station, train operating, fixed facilities maintenance, rolling stock maintenance, administration and management, but exclude depreciation.

Source: KNR and mission estimates.

(ii) Expressway Bus

| | | Per pass-km | |
|---|---|---|---|
| | | With 40 pass. | With 50 pass. |
| Operating costs (end 1976) | economic W 145/km | 3.63 | 2.90 |
| | financial W 178/km | 4.45 | 3.56 |
| Tariffs (end 1976) per pass-km | 1-200 km | 4.74 | |
| | 201-400 km | 4.34 | |

Source: MOT

Table 4.6

KOREA

SIXTH RAILWAY PROJECT

Financial Return on Capacity Increase for Passenger Services

| | Capital costs /a (W million) | Capacity Added by the Project /b | | Operating Profits /c | | |
|---|---|---|---|---|---|---|
| | | Special Express | Limited Express | Special Express | Limited Express | Total |
| | | (million pass-km) | | | (W million) | |
| 1978 | 27,100 | 170 | 1,050 | 780 | 3,150 | 3,930 |
| 1979 | 14,100 | 270 | 1,450 | 1,240 | 4,350 | 5,590 |
| 1980 | 1,500 | 290 | 1,590 | 1,330 | 4,770 | 6,100 |
| 1981 | 900 | 310 | 1,700 | 1,430 | 5,100 | 6,530 |
| 1982-2003 | - | 310 | 1,700 | 1,430 | 5,100 | 6,530 |
| | | | | Rate of return is 17% | | |

/a Includes investment in
- passenger coaches
- locomotives (on the basis of diesel loco-km for passenger trains)
- line capacity increases and telecommunication equipment allocated for passenger services (see detailed allocation of costs in Table 4.2).

/b Capacity resulting from acquisition of new coaches, calculation includes improvement in utilization of both existing and added stock.

/c Difference between operating costs excluding depreciation and revenues, i.e. W 4.6 per pass-km for Special Express and W 3.0 per pass-km for air-conditioned Limited Express (see Table 4.5).

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SIXTH RAILWAY PROJECT

Income Statements, 1971-81
(Won billion)

| | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Actual-/a | | | | | | Tentative | Forecast | | | |
| **Operating Revenues** | | | | | | | | | | | |
| Passenger revenue | 17.3 | 20.7 | 22.8 | 29.7 | 41.5 | 52.5 | 66.7 | 70.2 | 74.1 | 79.1 | 81.9 |
| Freight revenue | 11.6 | 13.3 | 15.7 | 19.5 | 28.9 | 43.5 | 59.5 | 65.1 | 70.2 | 74.3 | 79.3 |
| Other operating revenues | 2.3 | 2.5 | 3.1 | 3.8 | 5.2 | 6.6 | 8.9 | 7.6 | 8.1 | 8.6 | 9.0 |
| Subtotal Operating Revenues | 31.2 | 36.5 | 41.6 | 53.0 | 75.6 | 102.6 | 135.1 | 142.9 | 152.4 | 162.0 | 170.2 |
| Add: % Passenger fare increases | | | | | | | (10%) | 5.3 | (10%) 15.6 | (10%) 26.2 | (10%) 38.0 |
| % Freight rate increases | | | | | | | (15%) | 7.4 | (15%) 22.7 | (15%) 38.7 | (10%) 53.4 |
| Passenger revenue increases due to MRP /b | | | | | | | - | 3.2 | 5.9 | 8.8 | 11.6 |
| Subtotal | - | - | - | - | - | - | - | 15.9 | 44.2 | 73.7 | 103.0 |
| Re-stated operating revenues | 31.2 | 36.5 | 41.6 | 53.0 | 75.6 | 102.6 | 135.1 | 158.8 | 196.6 | 235.7 | 273.2 |
| **Operating Expenses** | | | | | | | | | | | |
| Labor | 13.2 | 13.8 | 14.3 | 17.7 | 26.4 | 44.6 | 60.7 | 72.3 | 81.4 | 91.5 | 102.2 |
| Fuel | 3.9 | 4.2 | 6.3 | 15.0 | 15.5 | 15.3 | 16.2 | 18.6 | 21.8 | 23.0 | 24.5 |
| Maintenance /c | 7.3 | 7.9 | 8.0 | 11.6 | 19.0 | 23.2 | 27.4 | 34.6 | 38.0 | 42.0 | 46.1 |
| General | 3.4 | 3.9 | 5.4 | 4.6 | 7.3 | 14.5 | 13.7 | 14.0 | 15.0 | 16.0 | 17.0 |
| Subtotal | 27.8 | 29.8 | 34.0 | 48.9 | 68.2 | 97.6 | 118.0 | 139.5 | 156.2 | 172.5 | 189.8 |
| Less: Economies due to MRP | - | - | - | - | - | - | - | 4.6 | 5.4 | 7.8 | 9.1 |
| Total cash expenses | 27.8 | 29.8 | 34.0 | 48.9 | 68.2 | 97.6 | 118.0 | 134.9 | 150.8 | 164.7 | 180.7 |
| Depreciation | 4.0 | 4.5 | 4.9 | 5.2 | 6.5 | 15.0 | 17.4 | 20.9 | 23.8 | 28.2 | 33.1 |
| Total operating expenses | 31.8 | 34.3 | 38.9 | 54.1 | 74.7 | 112.6 | 135.4 | 155.8 | 174.6 | 192.9 | 213.8 |
| Net operating revenue (loss) | (0.6) | 2.2 | 2.7 | (1.1) | 0.9 | (10.0) | (0.3) | 3.0 | 22.0 | 42.8 | 59.4 |
| Interest charges | 3.3 | 5.5 | 6.5 | 7.4 | 10.4 | 15.1 | 20.3 | 22.0 | 28.5 | 33.5 | 37.7 |
| Other revenues/expenses (net) /d | (0.7) | (7.6) | (3.3) | (23.2) | 5.4 | 1.7 | 0.5 | 1.0 | 1.3 | 1.5 | 1.8 |
| Net revenue (deficit) | (4.6) | (10.9) | (7.1) | (31.7) | (4.1) | (23.4) | (20.1) | (18.0) | (5.2) | 10.8 | 23.5 |
| Subsidy from Government | - | 0.7 | 1.5 | 5.7 | 14.4 | 13.7 | 21.7 | 14.6 | 12.0 | 7.5 | - |
| Net income (deficit) - adjusted | (4.6) | (10.2) | (5.6) | (26.0) | 10.3 | (9.7) | 1.6 | (3.4) | 6.8 | 18.3 | 23.5 |
| **Ratios** | | | | | | | | | | | |
| Operating Ratio | 102 | 94 | 93.5 | 102 | 99 | 110 | 100 | 98.0 | 89.5 | 82 | 78 |
| Interest charge coverage | - | 0.3 | 0.4 | - | 0.1 | - | - | 0.1 | 0.8 | 1.3 | 1.6 |
| Debt service coverage | 0.3 | 0.5 | 0.5 | 0.7 | 0.3 | 0.4 | 0.5 | 0.7 | 1.1 | 1.4 | 1.6 |
| Return on net fixed assets | - | 0.9 | 1.1 | - | 0.1 | - | - | 0.3 | 2.1 | 3.5 | 4.2 |

/a Actual - audited.

/b Management Rationalization Plan (revenue increase includes additional baggage revenues due to increase in charges).

/c Includes workshops labor costs.

/d Includes losses/gains on foreign exchange fluctuations.

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SIXTH RAILWAY PROJECT

Operating Revenues and Costs - Effects of Inflation, 1970-76

| Year | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 |
|---|---|---|---|---|---|---|---|
| | | | | (Currency Won) | | | |
| 1. Exchange rate (to US$) | 310 | 350 | 394 | 398.5 | 406 | 484 | 484 |
| 2. Price index: Wholesale | 100 | 108.6 | 123.8 | 132.4 | 189.6 | 238.2 | 267.0 |
| 3. Consumer | 100 | 112.1 | 125.5 | 129.3 | 160.0 | 202.0 | 233.1 |
| 4. Wages | 100 | 119.1 | 138.1 | 153.4 | 207.3 | 263.6 | 355 |
| 5. Wholesale (Imports) | 100 | 107.1 | 116.1 | 152.4 | 219.2 | 208.8 | 211.9 |
| 6. Average of 2, 3 and 5 /a | 100 | 109.4 | 121.8 | 138.0 | 189.6 | 216.3 | 237.3 |
| 6(a) Weighted /b | - | 113.9 | 129.0 | 144.7 | 195.6 | 232.0 | 279.7 |
| 7. Traffic-pass-km (million) | 9,818 | 8,750 | 10,062 | 10,720 | 11,077 | 12,926 | 14,305 |
| 8. Traffic-ton-km (million) | 7,709 | 7,841 | 7,241 | 8,593 | 9,005 | 9,293 | 9.728 |
| 9. Total traffic units (million) | 17,527 | 16,591 | 17,303 | 19,313 | 20,082 | 22,219 | 24,033 |
| 10. Revenues:/c Passenger | 19.4 | 17.3 | 20.7 | 22.8 | 29.7 | 41.5 | 52.5 |
| 11. Freight | 11.1 | 11.6 | 13.3 | 15.7 | 19.5 | 28.9 | 43.5 |
| 12. Other | 2.5 | 2.3 | 2.5 | 3.1 | 3.8 | 5.2 | 6.6 |
| 13. Total revenues | 33.0 | 31.2 | 36.5 | 41.6 | 53.0 | 75.6 | 102.6 |
| Operating expenses /c | | | | | | | |
| 14. Staff costs | 11.4 | 13.2 | 13.8 | 14.3 | 17.7 | 26.4 | 44.5 |
| 15. Other (excl. depreciation) | 12.4 | 14.6 | 16.0 | 19.6 | 31.2 | 41.8 | 53.0 |
| 16. Total working expenses | 23.8 | 27.8 | 29.8 | 34.0 | 48.9 | 68.2 | 97.6 |
| 17. Depreciation | 3.9 | 3.9 | 4.5 | 4.9 | 5.2 | 6.5 | 15.0 |
| 18. Total operating expenses | 27.7 | 31.7 | 34.3 | 38.9 | 54.1 | 74.7 | 112.6 |
| 19. Revenue per pass-km (10 ÷ 7) (won) | 1.976 | 1.977 | 2.057 | 2.127 | 2.681 | 3.210 | 3.673 |
| 20. Revenue per ton-km (11 ÷ 8) (won) | 1.440 | 1.479 | 1.837 | 1.827 | 2.165 | 3.110 | 4.636 |
| 21. Adjusted revenue per pass-km (19 ÷ 6(a)) (won) | 1.976 | 1.736 | 1.595 | 1.470 | 1.371 | 1.384 | 1.313 |
| 22. Adjusted revenue per ton-km (20 ÷ 6(a)) (won) | 1.440 | 1.299 | 1.424 | 1.263 | 1.107 | 1.341 | 1.657 |
| Costs Adjusted for Inflation | | | | | | | |
| 23. Staff costs (14 ÷ 4) | 11.4 | 11.1 | 10.0 | 9.3 | 8.5 | 10.0 | 12.6 |
| 24. Other costs (15 ÷ 6) | 12.4 | 13.3 | 13.1 | 14.2 | 16.5 | 19.3 | 22.3 |
| 25. Total working expenses | 23.8 | 24.4 | 23.1 | 23.5 | 25.0 | 29.3 | 34.9 |
| Working Expenses per Traffic Unit (won) | | | | | | | |
| 26. Current (16 ÷ 9) | 1.358 | 1.676 | 1.722 | 1.760 | 2.435 | 3.069 | 4.061 |
| 27. Deflated (26 ÷ 6a) (25 ÷ 9) | 1.358 | 1.471 | 1.334 | 1.216 | 1.245 | 1.323 | 1.452 |
| | 1.358 | 1.471 | 1.335 | 1.217 | 1.245 | 1.323 | 1.452 |
| Staff Statistics | | | | | | | |
| 28. Total staff | 43,800 | 43,600 | 44,300 | 41,200 | 39,900 | 39,500 | 39,300 |
| 29. Average cost per employee (14 ÷ 28) (won 000) | 260 | 303 | 311 | 347 | 444 | 668 | 1,135 |
| 30. Average cost per employee (deflated) (29 ÷ 4) | 260 | 255 | 227 | 227 | 214 | 255 | 321 |
| 31. Traffic units per employee (9 ÷ 28) (won 000) | 400 | 380 | 350 | 469 | 503 | 562 | 611 |
| Financial Ratios | | | | | | | |
| 32. Working ratio (16 ÷ 13) % | 72 | 89 | 82 | 82 | 92 | 90 | 92 |
| 33. Operating ratio (18 ÷ 13) % | 84 | 102 | 95 | 93 | 102 | 95 | 106 |
| 34. Debt service coverage | 1.7 | 0.3 | 0.3 | 0.5 | 0.7 | 0.3 | 0.4 |
| 35. Return on net fixed assets in use | 2.9 | - | 0.9 | 1.1 | - | 0.1 | - |

/a Arithmetic average.

/b Line $\frac{16 \times 100}{25}$

/c Billions of won

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KOREA

SIXTH RAILWAY PROJECT

Balance Sheets, 1971-81
(Won billions)

| Fiscal December 31 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Actual /b | | | | | | Tentative | Forecast | | | |
| Current Assets | | | | | | | | | | | |
| Cash | 0.5 | 0.4 | 1.4 | 1.8 | 3.3 | 5.4 | 5.9 | 3.1 | 3.1 | 3.1 | 3.1 |
| Accounts receivable | - | 3.6 | 4.5 | 4.0 | 7.5 | 9.4 | 8.1 | 11.0 | 12.8 | 17.4 | 19.5 |
| Total quick assets | 0.5 | 4.0 | 5.9 | 5.8 | 10.8 | 14.8 | 14.0 | 14.1 | 15.9 | 20.5 | 22.6 |
| Inventory | 11.2 | 3.7 | 4.0 | 5.5 | 9.5 | 14.6 | 15.1 | 18.4 | 21.0 | 23.2 | 26.0 |
| Total current assets | 11.7 | 7.7 | 9.9 | 11.3 | 20.3 | 29.4 | 29.1 | 32.5 | 36.9 | 43.7 | 48.6 |
| Current Liabilities | | | | | | | | | | | |
| Current portion of long-term debit | - | 2.3 | 2.3 | 3.1 | 3.3 | 4.6 | 4.8 | 5.2 | 6.5 | 7.5 | 9.0 |
| Accounts payable | - | 12.0 | 11.8 | 13.9 | 5.2 | 4.5 | 9.4 | 11.4 | 13.0 | 13.9 | 15.0 |
| All other | - | 5.3 | 4.2 | 5.1 | 5.4 | 6.2 | 6.0 | 7.0 | 8.0 | 8.5 | 9.0 |
| Total current liabilities | 16.4 | 19.6 | 18.3 | 22.1 | 13.9 | 15.3 | 20.2 | 23.6 | 27.5 | 29.9 | 33.0 |
| Net working capital | (4.7) | (11.9) | (8.4) | (10.8) | 6.4 | 14.1 | 8.9 | 8.9 | 9.4 | 13.8 | 15.6 |
| Fixed Assets | | | | | | | | | | | |
| Fixed assets | 173.1 | 197.4 | 207.1 | 232.0 | 274.5 | 736.9/c | 799.6 | 920.0 | 1,091.6 | 1,274.3 | 1,467.9 |
| Land | 33.9 | 33.7 | 130.2 | 127.5 | 130.5 | 223.2 | 225.9 | 265.4 | 292.8 | 317.3 | 341.3 |
| Gross book value | 207.0 | 231.1 | 337.3 | 359.5 | 405.0 | 960.1 | 1,025.5 | 1,185.4 | 1,384.4 | 1,591.6 | 1,809.2 |
| Less accumulated depreciation | 17.0 | 25.8 | 25.8 | 31.0 | 37.6 | 193.3 | 216.2 | 235.4 | 256.9 | 282.8 | 313.7 |
| Net book value | 190.0 | 205.3 | 311.5 | 328.5 | 367.4 | 766.8 | 809.3 | 950.0 | 1,127.5 | 1,308.8 | 1,495.5 |
| Add: Construction in progress | 6.5 | 24.5 | 29.1 | 42.2 | 43.0 | 24.1 | 32.7 | 32.7 | 32.7 | 32.7 | 32.7 |
| Total net fixed assets | 196.5 | 229.8 | 340.6 | 370.7 | 410.4 | 790.9 | 842.0 | 982.7 | 1,160.2 | 1,341.5 | 1,528.2 |
| Deferred assets /a | 32.5 | - | - | - | - | - | - | - | - | - | - |
| Other Assets | | | | | | | | | | | |
| Investments | 2.2 | 4.4 | 6.4 | 5.9 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Prepaid and other | 11.6 | 0.1 | 0.1 | 0.1 | - | - | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 |
| Total other assets | 13.8 | 4.5 | 6.5 | 6.0 | 0.1 | 0.1 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 |
| TOTAL ASSETS | 238.1 | 222.4 | 338.7 | 365.9 | 416.9 | 805.1 | 858.3 | 999.0 | 1,177.0 | 1,362.7 | 1,551.2 |
| Long-term debt | 75.3 | 80.5 | 100.5 | 154.6 | 194.5 | 245.1 | 275.0 | 340.3 | 420.6 | 482.8 | 533.0 |
| Provision for severance pay | - | 1.0 | 1.3 | 1.7 | 1.9 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 |
| Equity and/or Ownership /b | | | | | | | | | | | |
| Revaluation of assets | 72.9 | 77.6 | 177.1 | 175.3 | 175.2 | 521.0/c | 504.3 | 586.3 | 681.1 | 784.9 | 904.3 |
| Fixed capital (cash or in kind) | 73.2 | 69.7 | 69.9 | 70.4 | 71.0 | 71.1 | 64.9 | 82.5 | 99.0 | 116.2 | 119.3 |
| Accumulated surplus (deficit) | 16.7 | (6.4) | (10.1) | (36.1) | (25.7) | (35.4) | 10.8 | (13.4) | (27.0) | (24.5) | (8.7) |
| Total equity and/or ownership | 162.8 | 140.9 | 236.9 | 209.6 | 220.5 | 556.7 | 580.0 | 655.4 | 753.1 | 876.6 | 1,014.9 |
| TOTAL EQUITY AND LIABILITIES | 238.1 | 222.4 | 338.7 | 365.9 | 416.9 | 805.1 | 858.3 | 999.0 | 1,177.0 | 1,362.7 | 1,551.2 |
| Ratios | | | | | | | | | | | |
| Current ratio | 0.7 | 0.5 | 0.5 | 0.5 | 1.5 | 1.7 | 1.4 | 1.4 | 1.3 | 1.5 | 1.5 |
| Liquid ratio | - | 0.3 | 0.3 | 0.3 | 0.8 | 1.1 | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 |
| Debt/equity ratio | 32/68 | 36/64 | 30/70 | 42/58 | 47/53 | 29/71 | 32/68 | 35/65 | 36/64 | 36/64 | 35/65 |

/a Deferred loss on foreign exchange fluctuations.

/b 1972-76 figures adjusted according to audit reports.

/c Includes results of revaluation in 1976.

March 1978

KOREA

SIXTH RAILWAY PROJECT

Long-term Debt as of December 31, 1976

| | Year | Original amount | Amount outstanding (Won million) | Interest rate % | Repayment (years) Grace period | Repayment period |
|---|---|---|---|---|---|---|
| USAID - First loan | 1962 | ($) 6,388,391 | 1,239 | 5.75 | 1 | 20 |
| - Second loan | 1965 | ($) 10,711.923 | 2,578 | 5.75 | 1 | 20 |
| - Third loan | 1960 | ($) 18,509,995 | 3,443 | 5.75 | 1 | 15 |
| IDA - Cr. 25-KO | 1962 | ($) 13,992,924 | 3,952 | 5.75 | 1 | 25 |
| - Cr. 110-KO | 1967 | ($) 10,645,205 | 4,559 | 6.00 | 3 | 22 |
| - Cr. 183-KO | 1970 | ($) 15,000,000 | 7,548 | 7.00 | 4 | 21 |
| IBRD - Ln. 669-KO | 1970 | ($) 40,000,000 | 17,870 | 7.00 | 4 | 21 |
| - Ln. 863-KO | 1972 | ($) 40,000,000 | 18,560 | 7.25 | 4 | 21 |
| - Ln. 1101-KO | 1975 | ($) 100,000,000 | 25,914 | 8.50 | 5 | 20 |
| OECF (Japan) - First loan | 1966 | (Y) 4,279,388,398 | 3,706 | 5.75 | 2 | 18 |
| - Second loan | 1967 | (Y) 3,339,553,900 | 3,242 | 5.75 | 2 | 18 |
| - Third loan | 1972 | (Y) 15,408,000,000 | 25,568 | 5.00 | 5 | 15 |
| - Fourth loan | 1976 | (Y) 4,300,000,000 | - | 3.5 | 7 | 13 |
| UK | 1964 | (£) 500,000 | 116 | 6.75/7.75 | 4 | 10 |
| KFW - First loan | 1970 | (DM) 17,000,000 | 1,825 | 5.75 | 7 | 18 |
| - Second loan | 1973 | (DM) 17,000,000 | 3,271 | 5.75 | 7 | 18 |
| 50 C/S Group - Loan 1 | 1969 | | - 20,169 | | | |
| Loan 2 | 1970 | | 1,708 | | | |
| Loan 3 | 1974 | /a | 2,503 | /b | /c | /c |
| Loan 4 | 1975 | | 419 | | | |
| Exim Bank (US) - Loan 1 | 1968 | ($) 5,999,000 | } 17,036 | 6.00 | - | 7 |
| - Loan 2 | 1975 | ($) 3,780,000 | | 7.00 | 1 | 10 |
| Suppliers credits | | ($) | 2,218 | 5.25/6.20 | | |
| KDB - Various | 1966-76 | (W) | 66,662 | 6.00 | 5 | 15 |
| Ministry of Communications | 1976 | (W) | 10,000 | 6.00 | 5 | 15 |
| Total outstanding /d | | | 244,106 | | | |

/a In various currencies.
/b Varying between 6% and 8%.
/c Varying between 2 and 3 years' grace and 7-13 years' repayment.
/d On the basis of US$1.00 = Won 485.

Source: KNR.

KOREA

SIXTH RAILWAY PROJECT

Financial Forecasts - Methodology and Principal Assumptions

1. Traffic

Traffic will increase as forecast in Tables 2.5-2.10.

2. Revenues

(a) Basic

(i) Passenger revenues have been calculated on the basis of agreed traffic forecasts, analyzed under: Intercity commuters and noncommuters, (further subdivided under Saemul express, limited express, ordinary express and ordinary trains), military and Seoul Metropolitan Electric Suburban Railway Services (SMESRS), converted to revenues by applying the average revenue per passenger-km earned on each service during the first five months of 1977.

(ii) Freight revenues have similarly been calculated on the basis of agreed traffic forecasts analyzed under major commodities, converted to revenues by applying the average revenue per ton-km earned by each such commodity (or group of commodities), during the first five months of 1977.

(b) Increased Revenues

(i) Assuming tariff increases as discussed in para. 5.23 of the report. Although, as discussed in para. 2.33, such increases should be selective, the annual effect on revenues is treated as though they would be across-the-board./a

(ii) KNR has calculated increased passenger revenues, due to (a) upgrading of services on major trunk lines (additional sleeper trains and airconditioned limited express trains) and (b) tariff increases on baggage trains, due to service improvements.

3. Operating Expenses

(a) Labor Costs - KNR has calcuated the average number of staff needed each year, both for workshop and nonworkshop functions, and has calculated a basic annual cost on the current (1977) average annual cost per employee (workshop employees cost about 6% higher than

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/a In the Grey Cover report, the increases as agreed at negotiations will be indicated.

nonworkshop staff). Effect is then given to assumed annual cost increases averaging 12% in the years 1978-80, and 11% in 1981. Forecast savings due to staff reductions caused by the Management Rationalization Plan (MRP) are shown separately.

(b) Fuel Costs - KNR has estimated the engine-km needed to carry the forecast traffic, under engine types (diesel, electric and steam locomotives and diesel and electric railcars), then applying the current cost of fuel per engine-km (by type), and inflating the annual costs by factors of 8% p.a. in 1978 and 1979, and 7.5% p.a. in 1980 and 1981.

(c) Maintenance Costs - Costs are increased annually in line with traffic increases. For maintenance of facilities, KNR has forecast costs (excluding labor) increasing at 25% of the annual percentage increase in traffic units, while for maintenance of rolling stock 50% is used. Workshop labor costs are as calculated in (a) above. As in (b) above, annual costs (except labor) are inflated, using the same percentages.

(d) Other Costs - (Administrative and General), are based on 1977 budgeted costs, inflated thereafter as in items (b) and (c) above.

(e) Cost Savings - As mentioned in item (ii) above, KNR has estimated cost savings due to the MRP, for labor and other costs.

(f) Depreciation - KNR has based its calculations on the figures arrived at in 1976, taking into account the asset revaluation of that year. After eliminating land, the overall percentage of depreciation to gross fixed assets was found to be 2.4%. This is applied to the gross value excluding land as at the beginning of the year, to which the estimated annual revaluation is added (8% in years 1977-79, 7.5% in years 1980/81).

(g) Interest Charges - have been forecast on the basis of existing loans plus an estimated rate of 8% p.a. for new foreign borrowings, and 6% p.a. for new local borrowing. Grace periods for loans secured after 1977: Foreign, 4 years (except Eximbank, 1 year); Local, (KDB) 5 years.

4. Balance Sheet

(a) Receivables apply only to freight services, whereas passenger service is currently on a cash basis. As such, receivables are forecast on a 60-day basis, or 17% of total freight revenues.

(b) Inventories are forecast at about 12-13% of total operating costs.

(c) Accounts Payable were forecast on a basis of 6% of total cash expenses.

5. General

KNR's forecasts assume the Government's granting of cash subsidies to KNR for operations and/or investment of W 22.2 billion in 1977, W 11.0 billion in 1978, W 11.5 billion in 1979, W 9.7 billion in 1980 and W 3.1 billion in 1981.

KOREA

SIXTH RAILWAY PROJECT

Cash Flow Statement 1972-81
(Won billion)

| | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | Totals 1977-81 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actual | | | | | Forecast | | | |
| Sources of Funds | | | | | | | | | | | |
| Cash generated by KNR: | | | | | | | | | | | |
| Net operating revenue (loss) | 1.8 | 2.7 | (1.4) | 0.9 | (10.0) | (0.3) | 3.0 | 22.0 | 42.8 | 59.4 | 126.9 |
| Depreciation | 4.5 | 4.9 | 5.2 | 6.5 | 15.0 | 17.4 | 20.9 | 23.8 | 28.2 | 33.1 | 123.4 |
| Net nonoperating revenue (expense) | 0.1 | 1.3 | 6.3 | 3.5 | 6.4 | 0.5 | 1.0 | 1.3 | 1.5 | 1.8 | 6.1 |
| Total cash generated | 6.4 | 8.9 | 10.1 | 10.9 | 11.4 | 17.6 | 24.9 | 47.1 | 72.5 | 94.3 | 256.4 |
| Increase in severance pay provisions | - | - | 0.4 | - | 1.4 | - | - | - | - | - | - |
| Funds provided by Government: | | | | | | | | | | | |
| Operating subsidy | - | 1.5 | 5.7 | 14.4 | 13.7 | 21.7 | 14.6 | 12.0 | 7.5 | - | 55.8 |
| Investment | - | 0.8 | 0.5 | 0.6 | 0.9 | - | 3.0 | 4.5 | 9.7 | 3.1 | 20.3 |
| Sale of assets | - | - | - | - | - | 0.7 | 0.8 | 0.9 | 0.9 | 1.0 | 4.3 |
| Borrowing: | | | | | | | | | | | |
| Proposed Bank loan | - | - | - | - | - | - | 2.4 | 49.7 | 5.8 | - | 57.9 |
| Other foreign borrowing | - | - | - | - | - | 30.8 | 25.8 | 11.2 | 42.8 | 42.8 | 153.4 |
| Local | - | - | - | - | - | 33.3 | 51.5 | 35.0 | 33.0 | 30.0 | 182.8 |
| Total borrowing | 6.9 | 27.4 | 37.6 | 53.3 | 59.1 | 64.1 | 79.7 | 95.9 | 81.6 | 72.8 | 394.1 |
| Decrease in "Other Assets" | 22.9 | - | - | - | - | - | - | - | - | - | - |
| Ex/Railroad Fund | - | - | - | 6.0 | - | - | - | - | - | - | - |
| Total sources of funds | 36.2 | 38.6 | 54.3 | 85.2 | 86.5 | 104.1 | 123.0 | 160.4 | 172.2 | 171.2 | 730.9 |
| Application of Funds | | | | | | | | | | | |
| Capital investment | | | | | | | | | | | |
| Local currency | - | - | - | - | - | 45.7 | 58.4 | 54.9 | 66.3 | 66.3 | 291.6 |
| Foreign exchange | - | - | - | - | - | 30.8 | 28.2 | 60.9 | 48.6 | 42.8 | 211.3 |
| Total capital investment | 24.9 | 10.5 | 41.4 | 44.1 | 52.9 | 76.5 | 86.6 | 115.8 | 114.9 | 109.1 | 502.9 |
| Debt service | | | | | | | | | | | |
| Interest charges | 5.8 | 6.5 | 7.4 | 10.4 | 15.1 | 20.3 | 22.0 | 28.5 | 33.5 | 37.7 | 142.0 |
| Repayment | 10.7 | 8.0 | 9.8 | 11.1 | 14.6 | 15.9 | 14.4 | 15.6 | 19.4 | 22.6 | 87.9 |
| Total debt service | 16.5 | 14.5 | 17.2 | 21.5 | 29.7 | 36.2 | 36.4 | 44.1 | 52.9 | 60.3 | 229.9 |
| Increase in "Other Assets" | - | 10.3 | - | 2.7 | - | - | - | - | - | - | - |
| Unexplained charges to earned surplus | 0.4 | 2.0 | - | - | - | - | - | - | - | - | - |
| Net change in working capital | (5.6) | 1.3 | (4.3) | 16.9 | 3.9 | (8.6) | - | 0.5 | 4.4 | 1.8 | (1.9) |
| Total application of funds | 36.2 | 38.6 | 54.3 | 85.2 | 86.5 | 104.1 | 123.0 | 160.4 | 172.2 | 171.2 | 730.9 |

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KOREA

SIXTH RAILWAY PROJECT

Comparison of Traffic Forecasts and Actuals

A. Freight

| | Tons (million) | | | | | | Ton-km (million) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 863-KO | | | Actual | | | 863-KO | | | Actual | | |
| | Coal | Other | Total | Coal | Other | Total | Coal | Other | Total | Coal | Other | Total |
| 1972 | 11.66 | 18.92 | 30.58 | 11.3 | 20.3 | 31.6 | 2,682 | 4,688 | 7,370 | 2,620 | 4,621 | 7,241 |
| 1973 | 12.79 | 20.72 | 33.51 | 13.6 | 24.0 | 37.6 | 3,019 | 5,128 | 8,147 | 3,201 | 5,390 | 8,591 |
| 1974 | 12.82 | 22.20 | 35.02 | 15.1 | 24.3 | 39.4 | 3,026 | 5,423 | 8,449 | 3,408 | 5,597 | 9,005 |
| 1975 | 13.40 | 24.17 | 37.57 | 16.7 | 26.0 | 42.7 | 3,163 | 5,872 | 9,035 | 3,688 | 5,605 | 9,293 |
| 1976 | 13.76 | 25,91 | 39.67 | 16.1 | 27.7 | 43.8 | 3,248 | 6,263 | 9,511 | 3,662 | 6,066 | 9,728 |
| | 1101-KO | | | Actual | | | 1101-KO | | | Actual | | |
| 1974 | 14.7 | 25.9 | 40.6 | 15.1 | 24.3 | 39.4 | 3,375 | 5,699 | 9,074 | 3,408 | 5,597 | 9,005 |
| 1975 | 16.6 | 26.8 | 43.4 | 16.7 | 26.0 | 42.7 | 3,802 | 6,245 | 10,047 | 3,688 | 5,605 | 9,293 |
| 1976 | 17.6 | 30.1 | 47.7 | 16.1 | 27.7 | 43.8 | 4,105 | 6,768 | 10,873 | 3,662 | 6,066 | 9,723 |

B. Passengers

| | Passengers (million) | | | | | | | | Pass-km (million) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 863-KO | | | | Actual | | | | 863-KO | | | | Actual | | | |
| | LD /a | C /a | M /a | Total | LD | C | M | Total | LD | C | M | Total | LD | C | M | Total |
| 1972 | 95.4 | 42.0 | 1.7 | 139.1 | 109.2 | 26.3 | 1.6 | 137.1 | 8,590 | 953 | 510 | 10,053 | 8,914 | 629 | 519 | 10,062 |
| 1973 | 97.9 | 42.5 | 1.7 | 142.1 | 118.9 | 22.5 | 1.6 | 143.0 | 8,815 | 965 | 510 | 10,290 | 9,681 | 552 | 487 | 10,720 |
| 1974 | 97.6 | 75.0 | 1.7 | 174.3 | 140.4 | 26.6 | 1.5 | 168.5 | 8,784 | 1,206 | 510 | 10,500 | 10,011 | 596 | 471 | 11,078 |
| 1975 | 99.8 | 110.0 | 1.7 | 211.5 | 187.3 | 32.2 | 1.4 | 220.9 | 8,984 | 1,407 | 510 | 10,901 | 11,837 | 655 | 434 | 12,926 |
| 1976 | 101.0 | 150.0 | 1.7 | 252.7 | 210.5 | 36.9 | 1.3 | 248.7 | 9,090 | 1,650 | 510 | 11, 10 | 13,160 | 750 | 395 | 14,305 |
| | 1101-KO | | | | Actual | | | | 1101-KO | | | | Actual | | | |
| 1974 | 120.5 | 27.8 | 1.5 | 149.8 | 140.4 | 26.6 | 1.5 | 168.5 | 10,387 | 604 | 450 | 11,441 | 10,011 | 596 | 471 | 11,078 |
| 1975 | 165.9 | 88.4 | 1.5 | 255.8 | 187.3 | 32.2 | 1.4 | 220.9 | 11,740 | 1,544 | 450 | 13,734 | 11,837 | 655 | 434 | 12,926 |
| 1976 | 194.1 | 112.1 | 1.5 | 307.7 | 210.5 | 36.9 | 1.3 | 248.7 | 12,876 | 1,937 | 450 | 15,263 | 13,160 | 750 | 395 | 14,305 |

/a LD = Long Distance, C = Commuters, M = Military.

December 1977

Table 5.7

Sensitivity Analysis - Assuming Traffic Increases at 50% of Forecast Rate

With Tariff Increases as Proposed by the Government
(Won billion)

| | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|
| Operating Revenues (before tariff increases) | | | | | |
| Passengers | 66.7 | 67.8 | 68.7 | 73.4 | 75.1 |
| Freight | 59.5 | 62.4 | 65.0 | 66.9 | 69.4 |
| Other | 8.9 | 7.6 | 8.1 | 8.6 | 9.0 |
| Subtotal | 135.1 | 137.8 | 141.8 | 148.9 | 153.5 |
| MRP-increased revenues | - | 3.2 | 5.9 | 8.8 | 11.6 |
| Tariff increases - Passengers | - (10%) | 5.1 (10%) | 14.4 (10%) | 24.3 (10%) | 34.9 |
| - Freight | - (15%) | 7.1 (15%) | 21.0 (15%) | 34.8 (10%) | 46.7 |
| Total operating revenues | 135.1 | 153.2 | 183.1 | 216.8 | 246.7 |
| Operating Expenses | 135.4 | 155.0 | 172.6 | 189.7 | 210.0 |
| Net Operating Revenue | (0.3) | (1.8) | 10.5 | 27.1 | 36.7 |
| Interest | (20.3) | (22.0) | (28.5) | (33.5) | (37.7) |
| Other revenue | 0.5 | 1.0 | 1.3 | 1.5 | 1.8 |
| Net revenue | (20.1) | (23.8) | (16.7) | (4.9) | (0.8) |
| Debt Service | 36.2 | 36.6 | 44.4 | 53.1 | 60.5 |
| Cash Generation | | | | | |
| Net operating revenue | (0.3) | (1.8) | 10.5 | 27.1 | 36.7 |
| Other revenue | 0.5 | 1.0 | 1.3 | 1.5 | 1.8 |
| Depreciation | 17.4 | 20.9 | 23.8 | 28.2 | 33.1 |
| Total | 17.6 | 20.1 | 35.6 | 56.8 | 71.6 |
| Cash Surplus (deficit) | (18.6) | (16.5) | (8.8) | 3.7 | 11.1 |
| Net operating revenue (before traffic adjustment)/a | (0.3) | 3.0 | 22.0 | 42.8 | 59.4 |
| Net operating revenue (after traffic adjustment) | (0.3) | (1.8) | 10.5 | 27.1 | 36.7 |
| Reduction in net operating revenue | - | 4.8 | 11.5 | 15.9 | 22.7 |
| % of operating revenues | - | 3.1 | 6.3 | 7.3 | 9.2 |

/a Table 5.1.

Note:

| Cash generation | Project period | Plan period |
|---|---|---|
| | (Won billions) | |
| Net cash surplus (original) | (7.5) | 26.5 |
| Net cash surplus (revised) | (25.3) | (29.1) |
| Reduction in cash generation | 17.8 | 55.6 |

March 1978

Sensitivity Analysis - Assuming Traffic Increases at 100% of Forecast Rate

With 50% of Tariff Increases as Proposed by Government /a
(Won billion)

| | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|
| Operating Revenues (before tariff increases) | | | | | |
| Passengers | 66.7 | 70.2 | 74.1 | 79.1 | 81.9 |
| Freight | 59.5 | 65.1 | 70.2 | 74.3 | 79.3 |
| Other | 8.9 | 7.6 | 8.1 | 8.6 | 9.0 |
| Subtotal | 135.1 | 142.9 | 152.4 | 162.0 | 170.2 |
| MRP-increased revenues | - | 3.2 | 5.9 | 8.8 | 11.6 |
| Tariff increases - Passengers | - (10%) | 5.3 (5%) | 7.8 (5%) | 13.1 (5%) | 19.0 |
| - Freight | - (15%) | 7.4 (7.5%) | 11.3 (7.5%) | 19.4 (5%) | 26.7 |
| Total operating revenues | 135.1 | 158.8 | 177.4 | 203.3 | 227.5 |
| Operating Expenses (as on Table 5.1) | 135.4 | 155.8 | 174.6 | 192.9 | 213.8 |
| Net Operating Revenue | (0.3) | 3.0 | 2.8 | 10.4 | 13.7 |
| Interest | (20.3) | (23.0) | (28.1) | (34.7) | (41.4) |
| Other revenue | 0.5 | 1.0 | 1.3 | 1.5 | 1.8 |
| Net revenue (loss) | (20.1) | (19.0) | (24.0) | (22.8) | (25.9) |
| Debt Service | 36.2 | 37.5 | 43.7 | 54.1 | 64.0 |
| Cash Generation | | | | | |
| Net operating revenue | (0.3) | 3.0 | 2.8 | 10.4 | 13.7 |
| Other revenue | 0.5 | 1.0 | 1.3 | 1.5 | 1.8 |
| Depreciation | 17.4 | 20.9 | 23.8 | 28.2 | 33.1 |
| Total | 17.6 | 24.9 | 27.9 | 40.1 | 48.6 |
| Cash Surplus (deficit) | (18.6) | (12.6) | (15.8) | (14.0) | (15.4) |
| Net operating revenue (before tariff adjustment)/b | (0.3) | 3.0 | 22.0 | 42.8 | 59.4 |
| Net operating revenue (after tariff adjustment) | (0.3) | 3.0 | 2.8 | 10.4 | 13.7 |
| Reduction in net operating revenue | - | - | (19.2) | (32.4) | (45.7) |
| % of operating revenues | - | - | 10.8 | 15.9 | 20.1 |

/a After 1978 (1978 tariff increases are firm).

/b Table 5.1.

Note:

| Cash generation | Project period (Won billions) | Plan period (Won billions) |
|---|---|---|
| Net cash surplus (original) | 7.5 | 26.5 |
| Net cash surplus (deficit) revised | (28.4) | (76.7) |
| Reduction in cash generation | (35.9) | (103.2) |

March 1978

## Sensitivity Analysis - Assuming Traffic Increases at 50% of Forecast Rate

### With 50% of Tariff Increases as Proposed by Government /a

(Won billion)

| | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|
| Operating Revenues (before tariff increases) | | | | | |
| Passengers | 66.7 | 67.8 | 68.7 | 73.4 | 75.1 |
| Freight | 59.5 | 62.4 | 65.0 | 66.9 | 69.4 |
| Other | 8.9 | 7.6 | 8.1 | 8.6 | 9.0 |
| Subtotal | 135.1 | 137.8 | 141.8 | 148.9 | 153.5 |
| MRP-increased revenues | - | 3.2 | 5.9 | 8.8 | 11.6 |
| Tariff increases - Passengers | - (10%) | 5.1 (5%) | 10.6 (5%) | 15.6 (5%) | 20.5 |
| - Freight | - (15%) | 7.1 (7.5%) | 15.3 (7.5%) | 22.0 (5%) | 27.5 |
| Total operating revenues | 135.1 | 153.2 | 173.6 | 195.3 | 213.1 |
| Operating Expenses (as on page 1) | 135.4 | 155.0 | 172.6 | 189.7 | 210.0 |
| Net Operating Revenue (loss) | (0.3) | (1.8) | 1.0 | 5.6 | 3.1 |
| Interest | (20.3) | (22.8) | (28.4) | (35.3) | (42.6) |
| Other revenue | 0.5 | 1.0 | 1.3 | 1.5 | 1.8 |
| Net revenue (loss) | (20.1) | (23.6) | (26.1) | (28.2) | (37.7) |
| Debt Service | 36.2 | 38.2 | 44.0 | 54.7 | 65.2 |
| Cash Generation | | | | | |
| Net operating revenue (loss) | (0.3) | (1.8) | 1.0 | 5.6 | 3.1 |
| Other revenue | 0.5 | 1.0 | 1.3 | 1.5 | 1.8 |
| Depreciation | 17.4 | 20.9 | 23.8 | 28.2 | 33.1 |
| Total | 17.6 | 20.1 | 26.1 | 35.3 | 38.0 |
| Cash Surplus (deficit) | (18.6) | (18.1) | (17.9) | (19.4) | (27.2) |
| Net operating revenue (before traffic & tariff adjustment) /b | (0.3) | 3.0 | 22.0 | 42.8 | 59.4 |
| Net operating revenue (after traffic & tariff adjustment) | (0.3) | (1.8) | 1.0 | 5.6 | 3.1 |
| Reduction in net operating revenue | - | (4.8) | (21.0) | (37.2) | (56.3) |
| % of operating revenues | - | 3.1 | 12.1 | 19.2 | 26.4 |

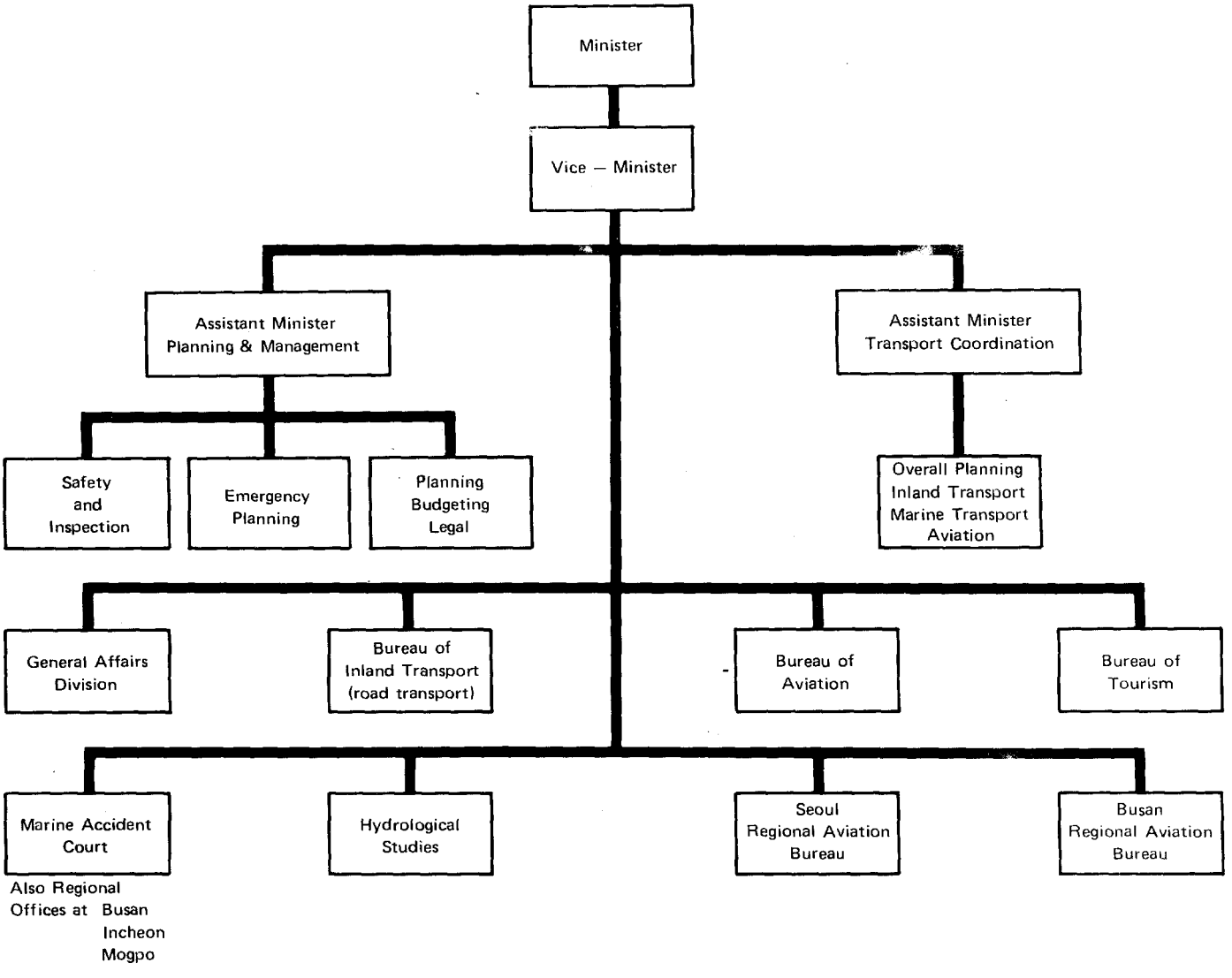
/a After 1978 only.

/b Table 5.1.

Note:

| Cash generation | Project period | Plan period |
|---|---|---|
| | (Won billions) | |
| Net cash surplus (original) | 7.5 | 26.5 |
| Net cash surplus (deficit) | (32.4) | (97.6) |
| Reduction in cash generation | (39.9) | (124.1) |

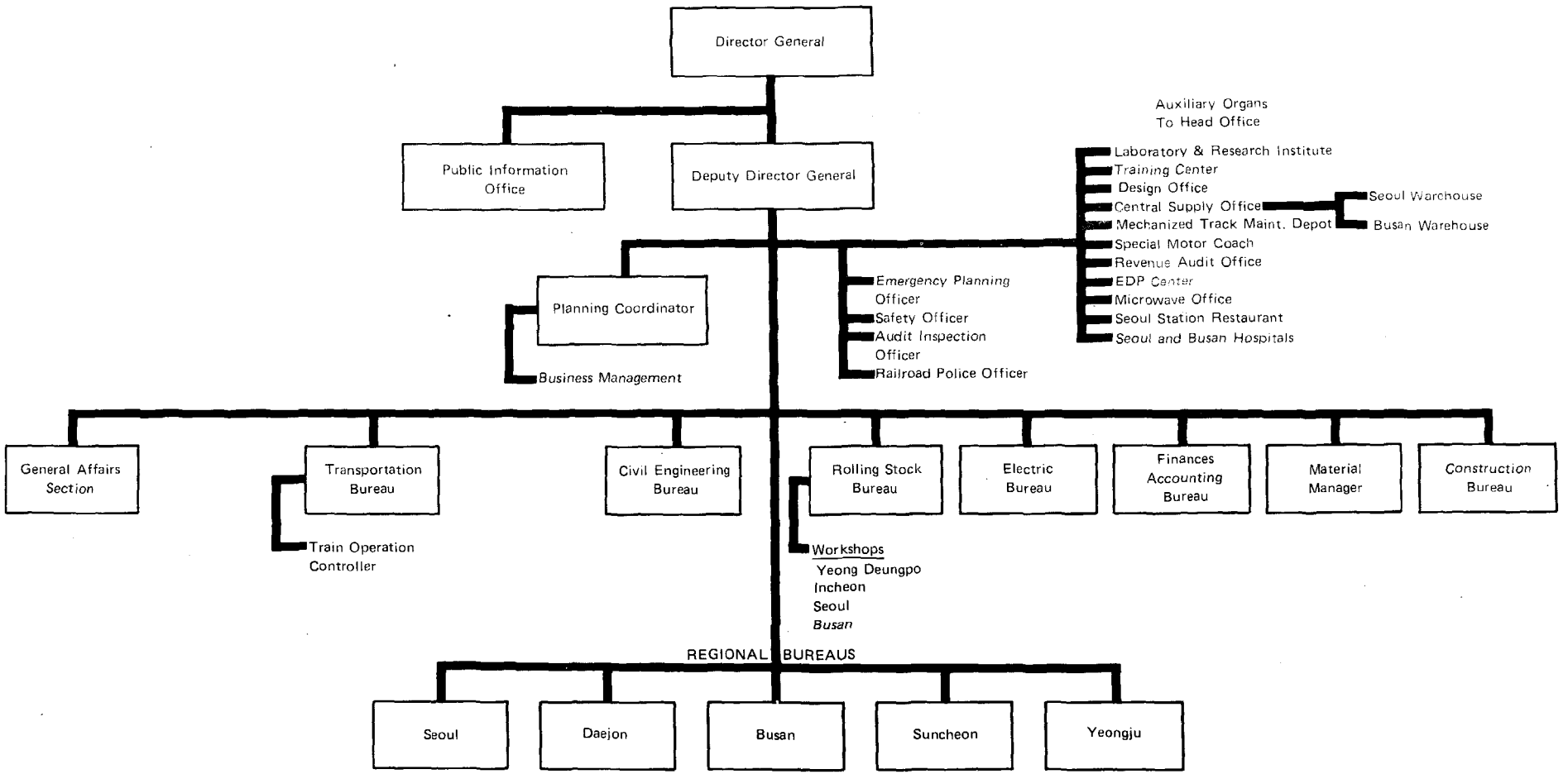
KOREA
APPRAISAL OF A SIXTH RAILWAY PROJECT
Ministry of Transportation
Organization Chart




Note: Railways (KNR) and ports (KMPA)
report directly through the Vice–Minister and Minister

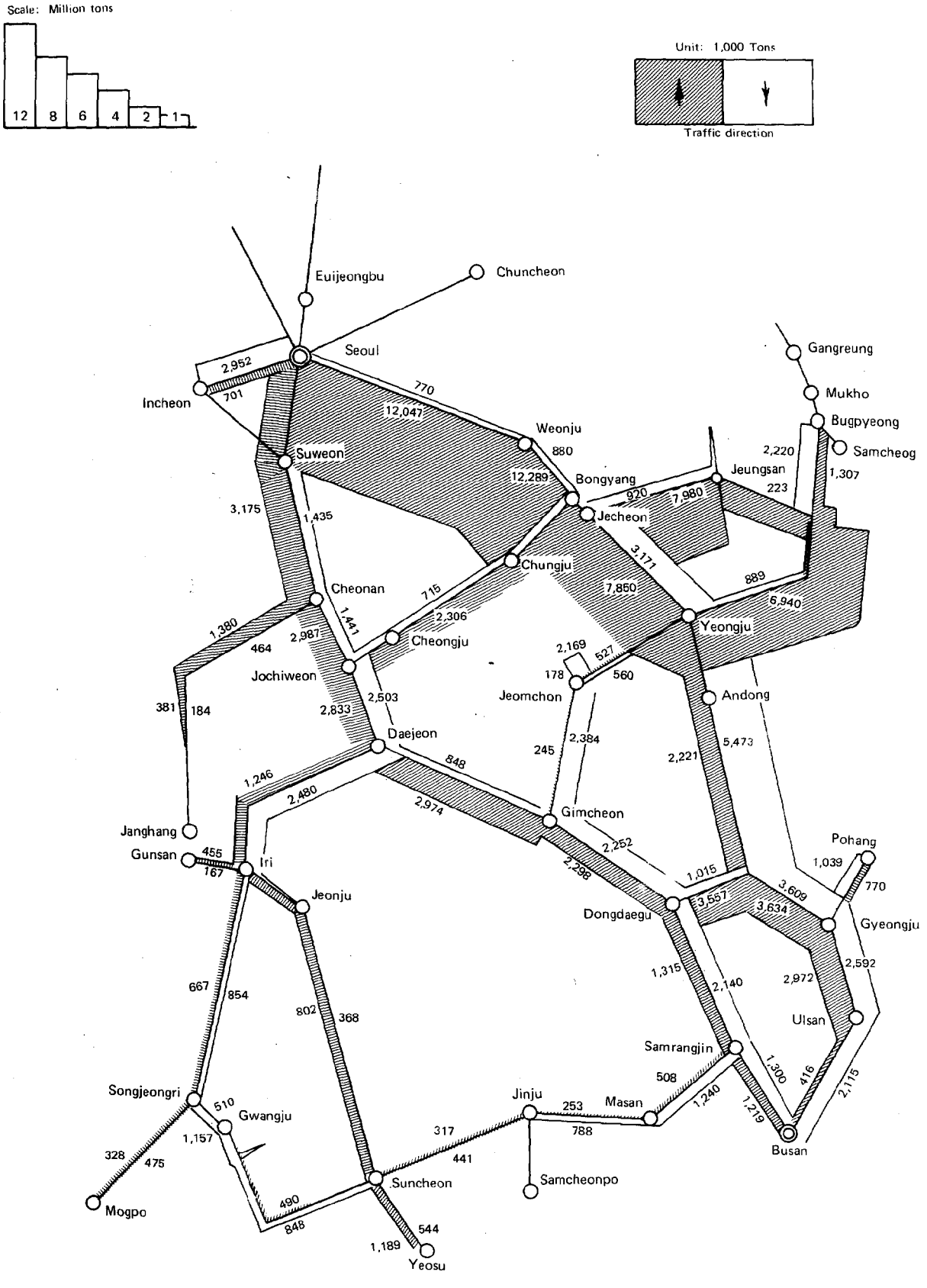
World Bank – 18023

KOREA
APPRAISAL OF A SIXTH RAILWAY PROJECT
Korea National Railroad Organization



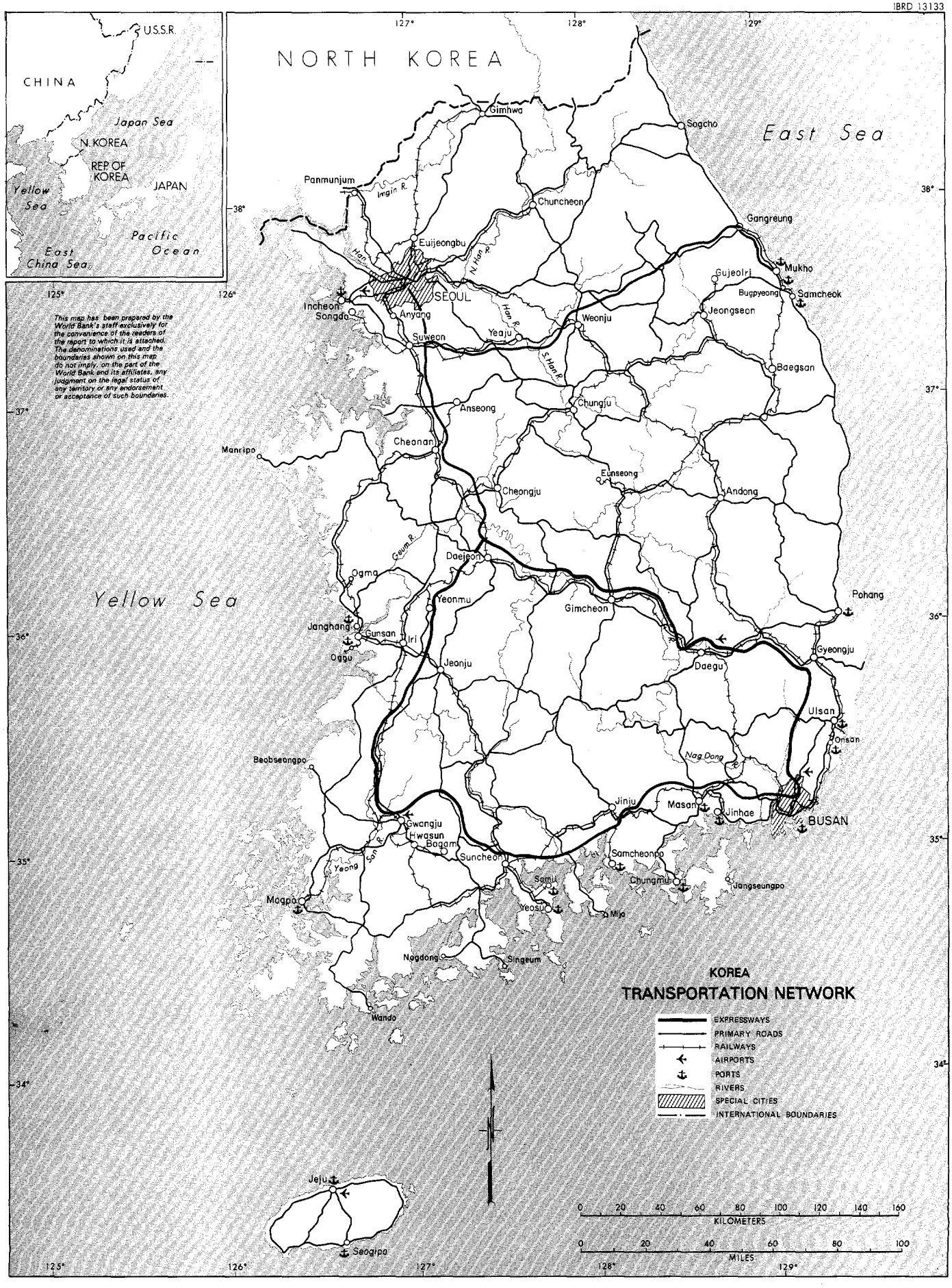

World Bank – 18024

KOREA
APPRAISAL OF A SIXTH RAILWAY PROJECT
KNR FREIGHT TRAFFIC DENSITY
(1976)




N.B. Seoul intracity traffic is not shown

World Bank – 18070

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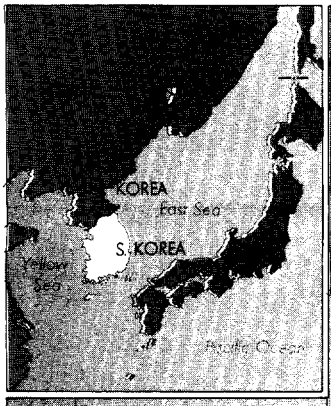







**MAIN LINES**

| | |
|---|---|
| GYEONG BU LINE | Seoul-Busan |
| JUNG ANG LINE | Chaongyangni - Gyeongju |
| GYEONG IN LINE | Yeongdeungpo - Incheon |
| JANG HANG LINE | Cheonan - Janghang |
| CHUNG BUG LINE | Jochiwaon - Bongyang |
| GYEONG BUG LINE | Gimchaon - Yeongju |
| BAE GU LINE | Daegu - Yeongcheon |
| GYEONG EUI LINE | Seoul - Munsan |
| GYEONG WEON LINE | Yongsan - Sintanri |
| GYEONG CHUN LINE | Seongbug - Chuncheon |
| HO NAM LINE | Daejeon - Mogpo |
| JEON RA LINE | Iri - Yeosu |
| DONG HAE NAM BU | Busanjin - Poheng |
| TAE BAEG LINE | Jecheon - Baegsan |
| YEONG DONG LINE | Yeongju - Gyeongpodae |

**UNECONOMIC LINES**

| | |
|---|---|
| SU IN LINE | Suwaon - Songdo |
| UIN SAN LINE | Ganyang - Samcheonpo |
| AN SEONG LINE | Cheonan - Anseong |
| CH SU LINE | Gunsan - Oggu |
| HWA SUN LINE | Hwasun - Bogam |
| KIM PO LINE | Yongsan - Kimpo |
| YONG SAN LINE | Yongsan - Dangjin |

# KOREA
# NATIONAL RAILROAD NETWORK

DOUBLE TRACK LINES
SINGLE TRACK LINES
ELECTRIFIED LINES
UNECONOMIC LINES
MAJOR STATIONS
INTERNATIONAL BOUNDARIES

0 20 40 60 80 100
KILOMETERS
0 20 40 60 80
MILES

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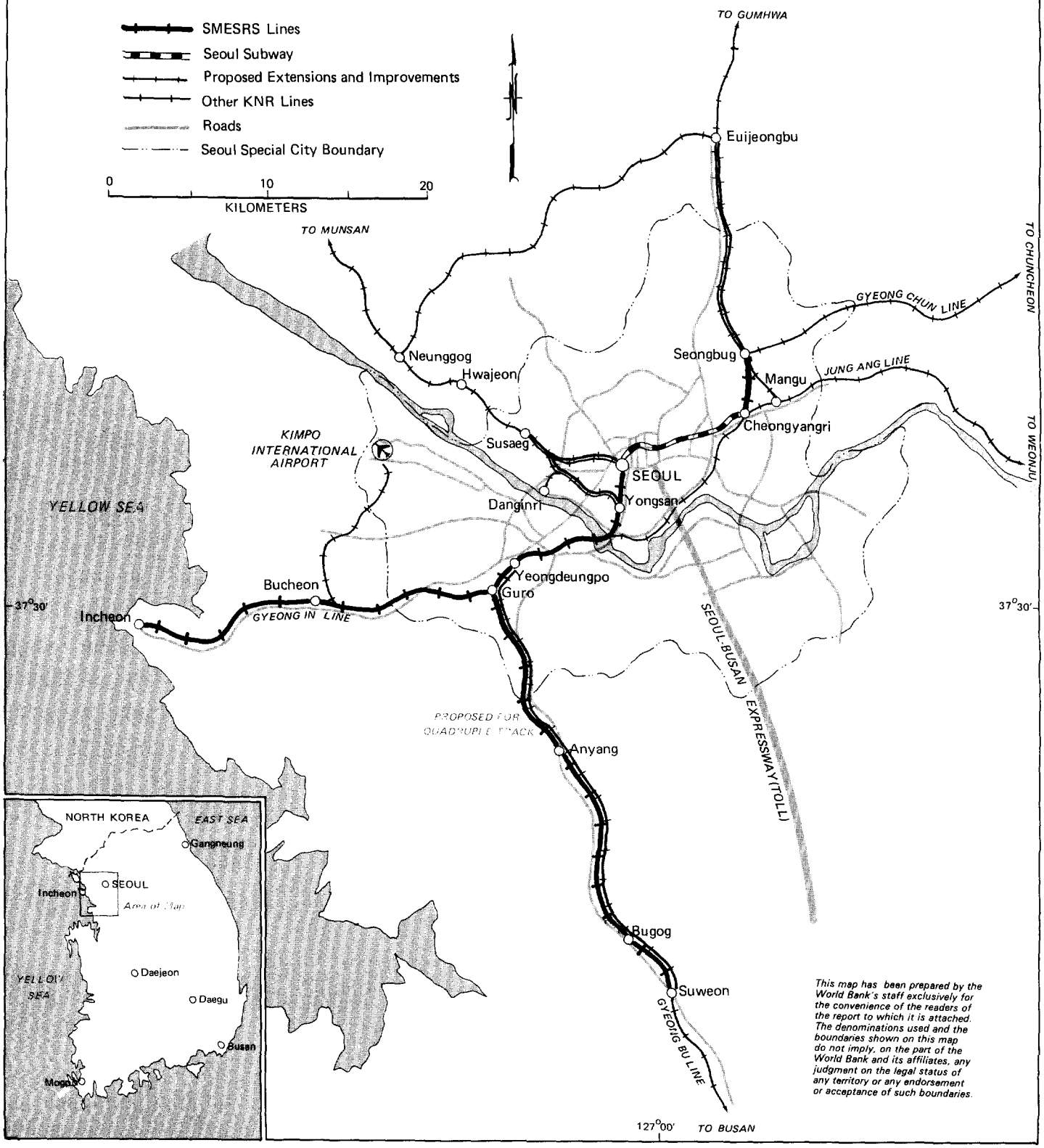
NOVEMBER 1977

# KOREA

## Seoul Metropolitan Electrified Suburban Railway System (SMESRS)

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